ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

DECEMBER 17, 1949

WRENCH IT!

Interlocked—seam hubs won't give, turn or break off!

SOCK IT!

If abnormal abuse should deform the steel, just bend it back again — the interlocked-seam hubs will stay watertight!

DROP IT!

Even screwed onto a twelve-foot length of conduit, this socket takes terrific punishment!

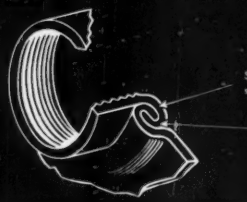
NOW!

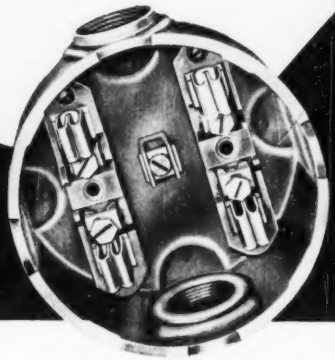
NEW STRENGTH! NEW STAMINA! NEW ENDURANCE!

in the IMPROVED Murray Steel METER SOCKET

How do we do it?

Take a look at this precision interlocked seam that anchors hubs to shell in the improved Murray meter socket. Engineers said it couldn't be done — yet here it is. Rigid . . . rugged . . . waterproof — these hubs *can't* loosen up, *can't* fall out, *can't* break off. No welds, no die castings, no flimsy alloys — just tough, sturdy, dependable steel.





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MANUFACTURING CORPORATION

50 Years of Service to the Electrical Industry

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The *improved* Murray steel meter socket is weatherproofed by zinc coating and baked-on melamine finish. Two or three hubs, size 1" or 1¼"; four, five or six jaws. Reversible jaws for horizontal or vertical mounting. Solderless connectors can be swung into the gutter for bussing. Connectors take No. 1 wire.

The *improved* Murray meter socket is available either separately or in this preassembled yard-pole combination with Murray fully magnetic circuit breaker protection, approved by R.E.A. Write for complete specifications.

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SWITCHES • CURRENT LIMITING REACTORS • CROWS'NEST AERIAL LADDERS

ELECTRICAL WORLD

Published for 75 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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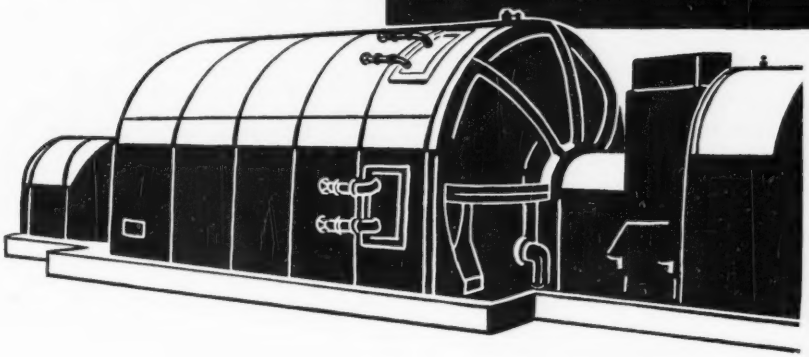
against rust, sludge and foam



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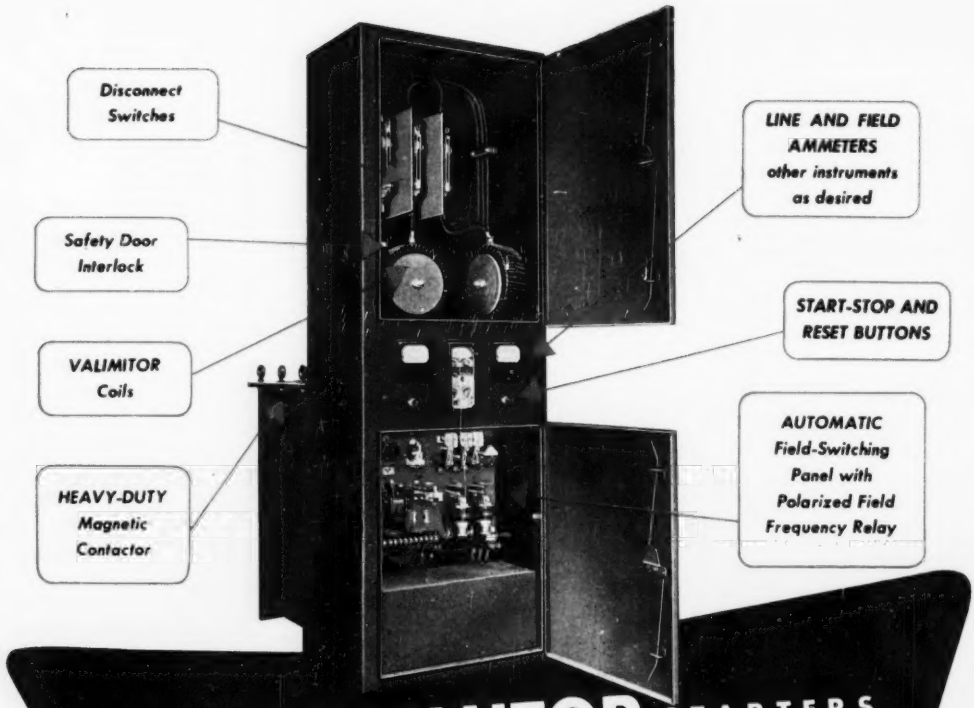
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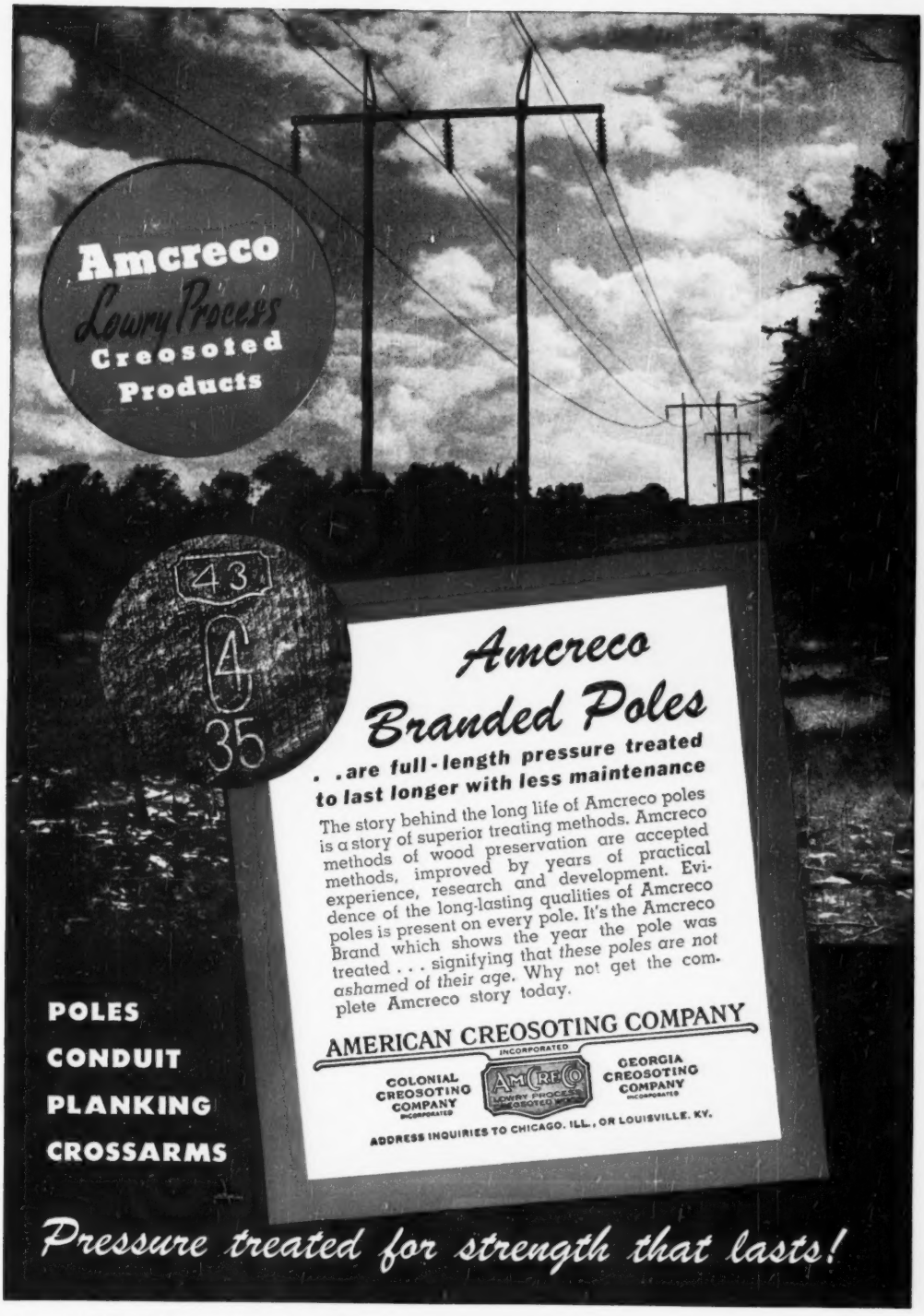
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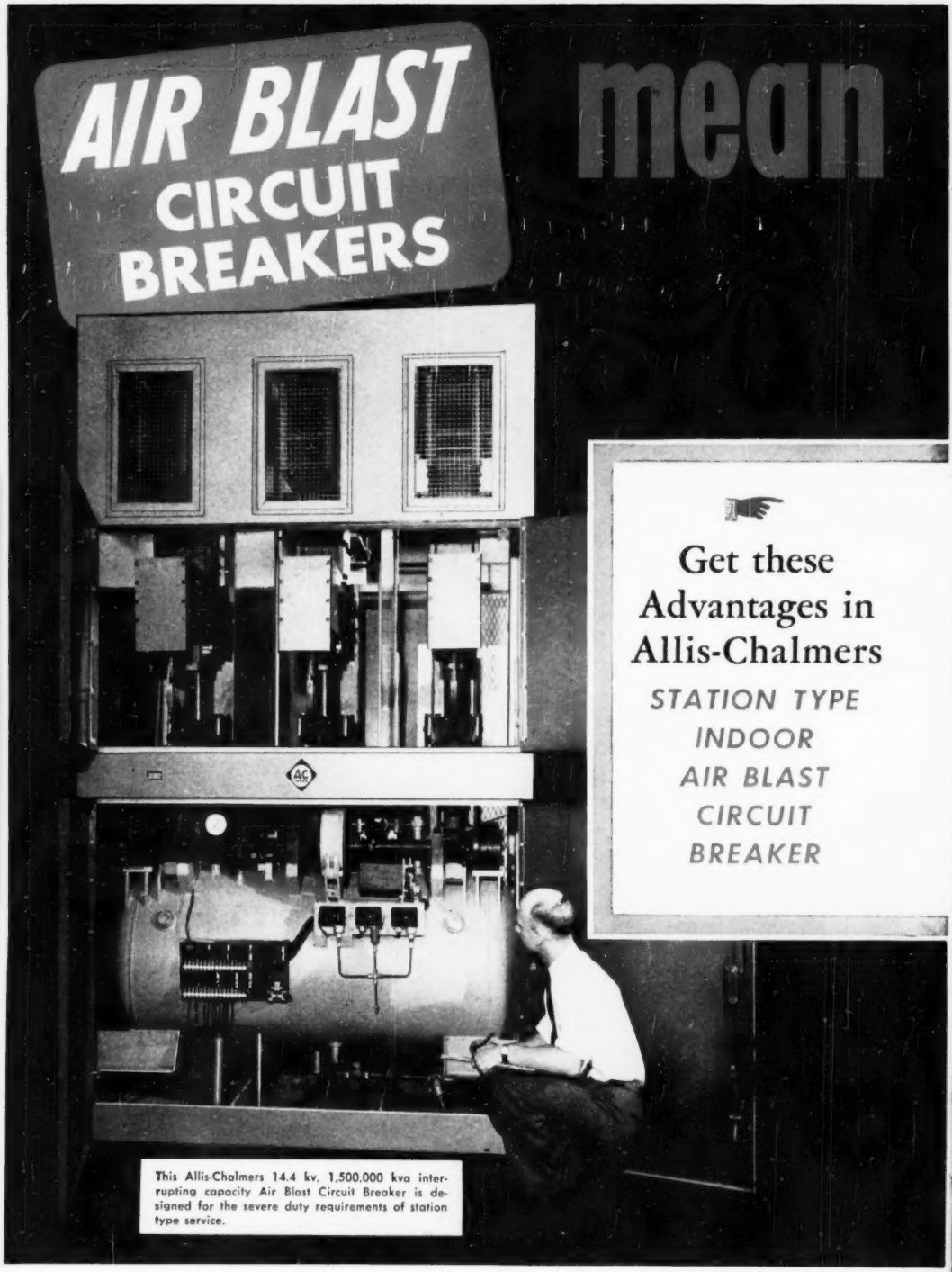
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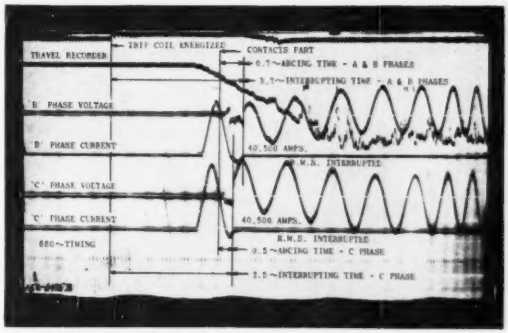

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CREW COMPARTMENT-LINE CONSTRUCTION BODY

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Equally important, the B-4 has space for all of the diversified equipment needed for line work. Roomy, locked compartments on each side of body carry small items. Inside, the big body has ample space and 12 swivel material hooks.

The derrick tunnel permits easy loading and unloading of derrick at shoulder height. Ladder racks are adjustable. Extended platform protects men when loading or unloading material, and gives additional body floor capacity.

The B-4 body can be mounted on any conventional or C.O.E. type of chassis. There are three body lengths . . . 132", 156" and 168". CA dimensions range from 83" to 113".

Complete information on the universally used B-4 is yours for the asking.

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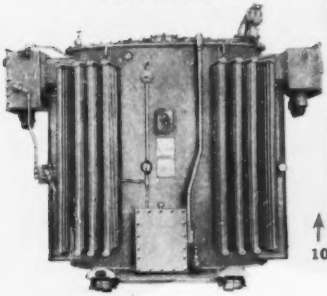
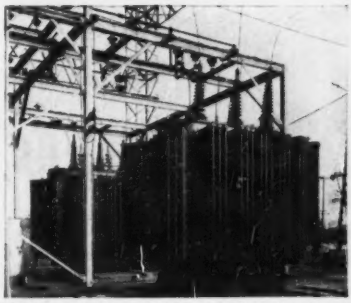
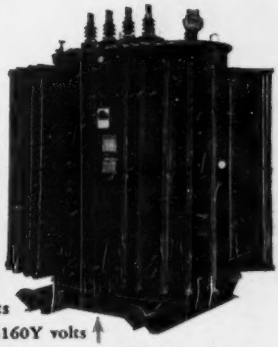


2500 Kva, 3 phase, 13200Y-2400 Δ volts



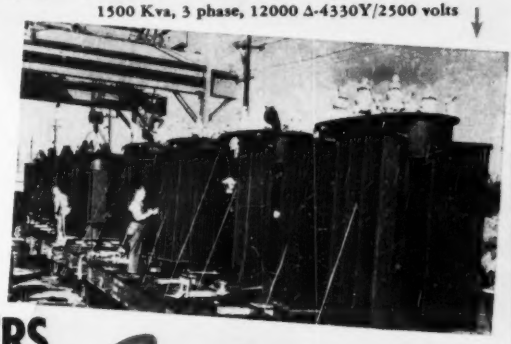
10000 Kva, 3 phase, 66000 Δ-12470Y/7200 volts



3750 Kva, 3 phase, 12000 Δ-2400 Δ/4160Y volts

1500 Kva, 3 phase, 12000 Δ-4330Y/2500 volts

Others are SAVING UP TO 8% on their POWER TRANSFORMERS



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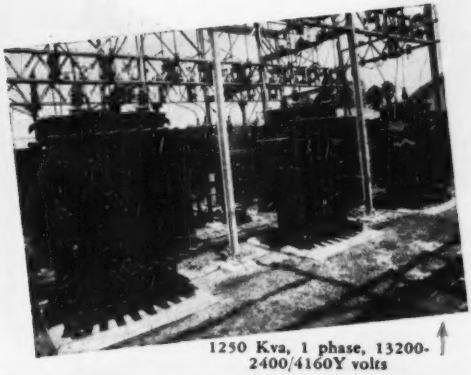

1250 Kva, 1 phase, 13200-2400/4160Y volts

Here are some Standard Parts Power Transformers that have been manufactured in the Pennsylvania Plant and delivered to Utilities and Industrials in various parts of the country.

Because these are Standard Parts Transformers, they were purchased at considerable discounts — up to 8%.

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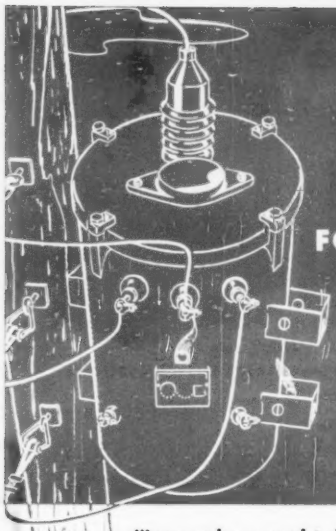
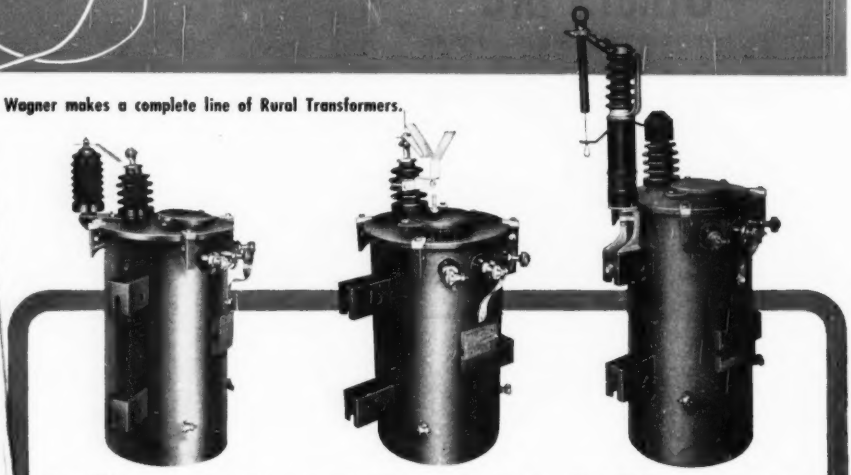


choose a Wagner rural-line Transformer

FOR INCREASED SYSTEM EFFICIENCY

Expert engineering, skillful workmanship and precision manufacture give Wagner Rural-Line Transformers the ability to provide the kind of satisfactory, continuous operation that reduces maintenance costs and consumption losses to a minimum. They have established *proven* service records in the field and support the enviable reputation of Wagner Transformers.

Wagner makes a complete line of Rural Transformers.



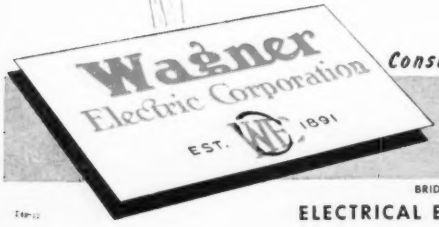
Type HEF-3—De-Ion Gap on high-voltage side provides surge protection; secondary circuit-breaker protects transformer against secondary short-circuits and overloads. Breaker reset handle is easily accessible; on sizes 5 kva and above, a warning signal light is built into the reset handle.

Type HEF-5—Double "bird-proof" gap provides surge protection; internal fuse forms a protective link between the transformer and the high-voltage line to prevent "line lockout" if the transformer is damaged in operation. When double gap and internal fuse are combined no other surge protection or transformer fuses are required.

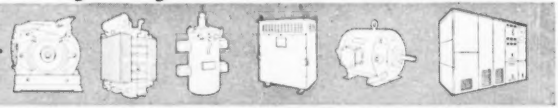
Type HEF-7—Equipped with a Jos-lyn Lightning Arrester to provide surge protection and a primary overload limiter link, which is an "extended range" link, that withstands momentary surges even in fractional ampere ratings, yet protects the transformer against harmful overloads and secondary faults. A blown fuse can be quickly replaced, reducing the time required to put the transformer back in service.

For further information on Wagner Rural-Line Transformers, write for Bulletin TU-1C.

Wagner Electric Corporation
6465 Plymouth Ave., St. Louis 14, Mo., U. S. A.



Consult Wagner Engineers on All Transformer Problems



BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

ELECTRICAL EQUIPMENT AND AUTOMOTIVE BRAKE PRODUCTS

NOT TOO LITTLE . . .

NOT TOO MUCH . . .

BUT THE RIGHT LIGHT FOR EVERY INDUSTRIAL NEED . . .

APPLETON LIGHTING EQUIPMENT

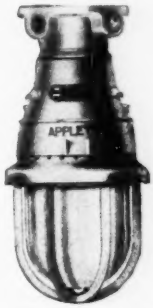
Here's lighting equipment that is designed for quick, easy and economical installation . . . that provides lasting, trouble-free, low-cost operation . . . that blankets every industrial illuminating requirement, whether indoors or out.

With Appleton Lighting Equipment you are assured of the utmost in illuminating efficiency . . . good light without uncomfortable glare or troublesome shadow. Appleton vitreous-fired porcelain enamel reflectors diffuse light generously, utilizing full power of the lamp, providing evenly distributed light over wider areas.

Sectionalized construction of Appleton Lighting Equipment assures easy cleaning and re-lamping. Rugged, weather-proof finish and materials mean longer life, greater adaptability. For the finest in lighting equipment, specify Appleton—Standard for Better Lighting.

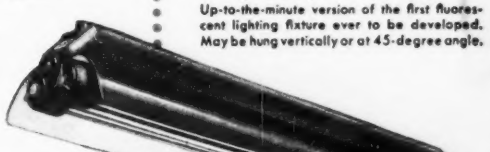
Sold Through Electrical Wholesalers

Industrialite High Mounting Fixture
For use in railroad yards and roundhouses, steel mills, foundries, hundreds of industrial installations.



New Vented Type EVX
Explosion-Proof Fixture
Sturdily built of tough, malleable iron, this fixture provides safe superior illumination for hazardous locations. 10% greater light, 30% lighter in weight—cooler operating!

Type EFU Explosion-Proof Fixture
Up-to-the-minute version of the first fluorescent lighting fixture ever to be developed. May be hung vertically or at 45-degree angle.



APPLETON ELECTRIC COMPANY

1705 WELLINGTON AVENUE • CHICAGO 13, ILLINOIS

Branch Offices: NEW YORK, 50 Church St. • DETROIT, 3049 E. Grand Blvd. • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Minna St. • ST. LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 N. Santa Fe Avenue • ATLANTA, 724 Boulevard, N. E. • BIRMINGHAM 429 Brown-Marx Bldg. • MINNEAPOLIS, 305 Fifth St., S. • PITTSBURGH, 414 Bessemer Bldg. • BALTIMORE, 100 E. Pleasant St. • BOSTON, 10 High St. • DENVER, 1921 Blake St. • PHILADELPHIA, 1017 Cherry Street • CINCINNATI, 626 Broadway • HOUSTON, 738 M. & M. Bldg.

Resident Representatives: Dallas, Indianapolis, Jacksonville, Kansas City, Milwaukee, Seattle
Export Representatives: International Standard Electric Corp., 67 Broad St., New York 4, N. Y.

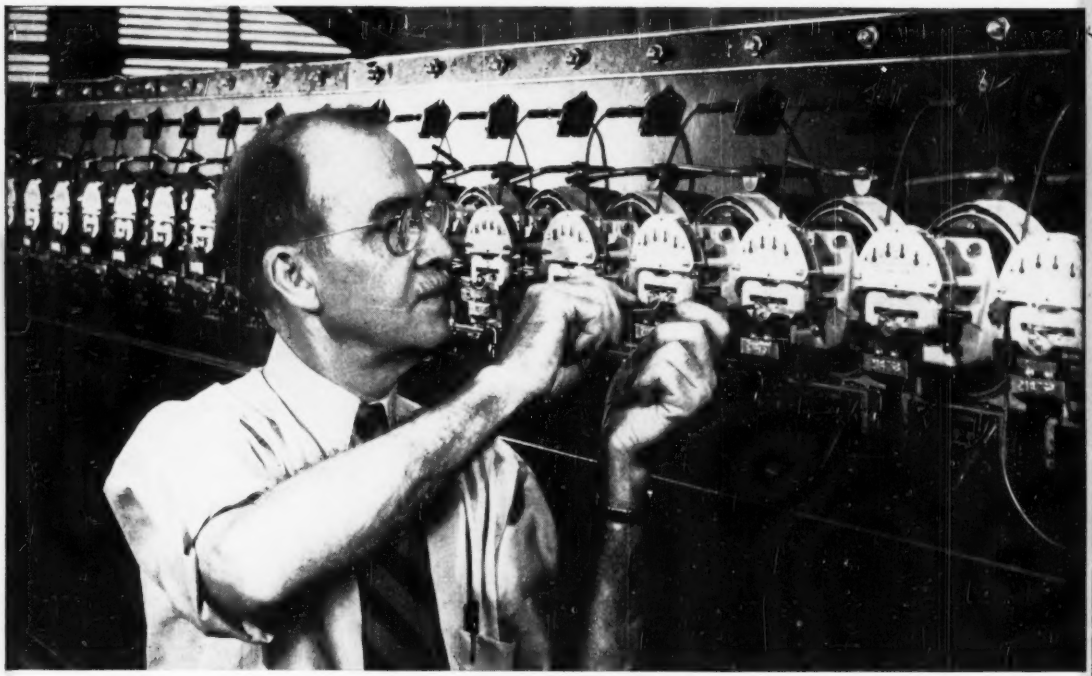
APPLETON ELECTRIC PRODUCTS

WRITE FOR COMPLETE CATALOG INFORMATION

APPLETON

CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

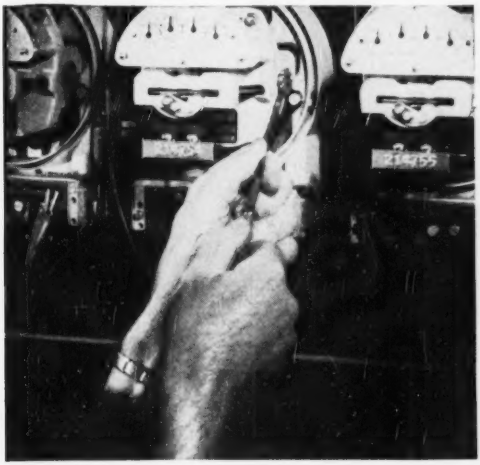
METER TESTERS *Prefer* Sangamo Watthour Meters....



SIMPLE full load and light load adjustments—*readily accessible from the front*, exceptionally clear visibility of disk and its markings, and easy removal of registers—by simply releasing two small locking levers, are a few of the reasons why Sangamo J Watthour Meters are favorites with utility company meter testers everywhere. Faster meter testing, resulting from these advantages, saves man-hours—either in automatic group testing or in individual testing. Further, Sangamo J Meters as received, seldom need any calibration to meet all generally accepted standards of accuracy.

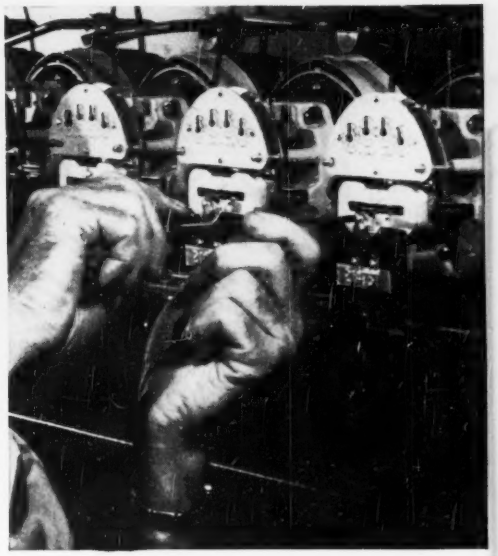
50TH ANNIVERSARY SANGAMO 1899 - 1949

. . . *Faster* TO TEST -- *Easier* TO CALIBRATE!



Making Light Load Adjustment

It's positive—no backlash—and just as easy as it looks. Place screwdriver in slot, move slightly, and "it's right on the button."



Making Full Load Adjustment

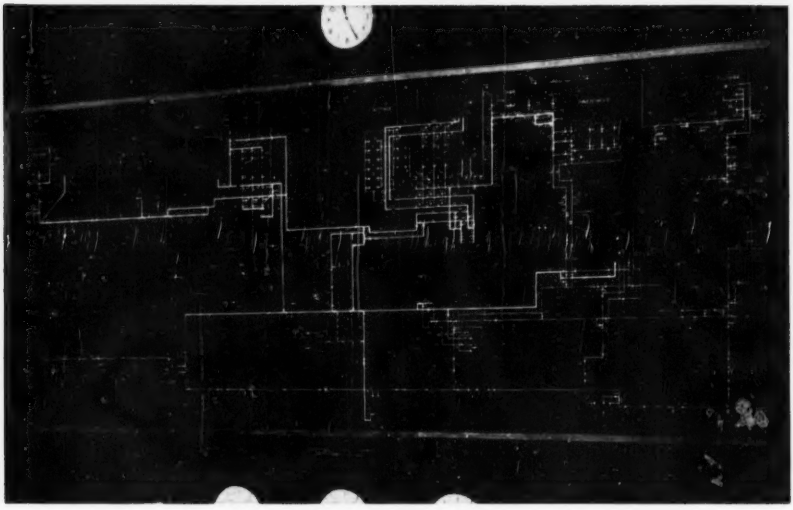
Easily and quickly adjusted with ample range for any normal service calibration, the micrometer full load adjustment—a simple steel screw—is accessible with an ordinary screwdriver from the front. Movement of the magnet assembly provides additional range of adjustment if required after replacement of major parts.

Sangamo J Meters have proved their ability to meet the requirements of today and the anticipated loads of the future with sustained accuracy, economy of maintenance and troublefree performance.

SM457

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

This circuit diagram is made up of individual panels of Graphic Lamicoid. Permanent clarity and durability is assured by the resistance of Lamicoid to wear and abuse, moisture, and corrosive vapors.



Graphic Lamicoid

for clarity, durability and economy

The circuit diagram above is attractive and easy to read—and it will stay that way for years. Upkeep cost is low, too, because it's made of Graphic Lamicoid.

Graphic Lamicoid is a rigid, tough, and moisture resistant panel, with printed matter permanently laminated in the thermosetting plastic sheet. Special age-resisting resins make a clear protective surface over the printed matter—a surface that resists wear and chipping and won't check or cloud. Graphic Lamicoid (with regular printed material) is especially economical where many panels with identical markings are desired; yet panels with different markings can be produced at minimum cost by the use of Van Dyke reproductions, as in the circuit diagram illustrated.

Graphic Lamicoid can be drilled, tapped, punched or sawed—so it's easy to install. It can be cleaned in seconds with a damp cloth—so it's no trouble in upkeep. It resists moisture, oils, corrosive vapors and temperature extremes—so it lasts and lasts.

Features like these make Graphic Lamicoid an ideal material for economical production of clear and durable signs, dials, nameplates, wiring diagrams and plotting boards. Engraving and Translucent types of Lamicoid are also available. For further information, contact our nearest sales office or fabricator.

MICA ELECTRICAL INSULATION

MICA *Insulator* COMPANY

Schenectady 1, New York

Offices in Principal Cities

WICKWIRE ROPE

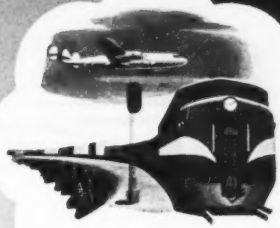
A PRODUCT OF CF&I

Ask any user... you'll find them everywhere

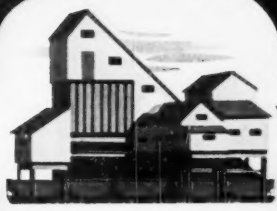
In scores of industries, users of Wickwire Rope have developed an affectionate respect for its performance, safety and long life. And, for true economy, they use Wickwire's WISSCOLAY® Preformed. It lasts longer—is easier to cut, splice and install. It's kink-resistant and safer to handle. Wickwire Distributors and Rope Engineers, in key cities everywhere, are prepared to render prompt service in meeting your wire rope needs. Wickwire Rope Sales Office and Plant—Palmer, Mass.

IN THE EAST—Wickwire Spencer Steel Div. of C. F. & I.
500 Fifth Ave., New York 18, N. Y.
IN THE ROCKIES—The Colorado Fuel and Iron Corp.
Continental Oil Bldg., Denver, Colo.
ON THE WEST COAST—The California Wire Cloth Corp.
1080—19th Ave., Oakland 6, Cal.

LOGGING

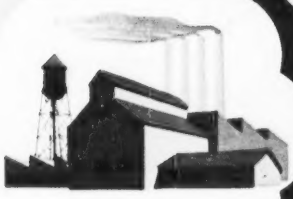


TRANSPORTATION

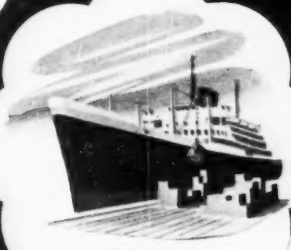


MINING

PETROLEUM



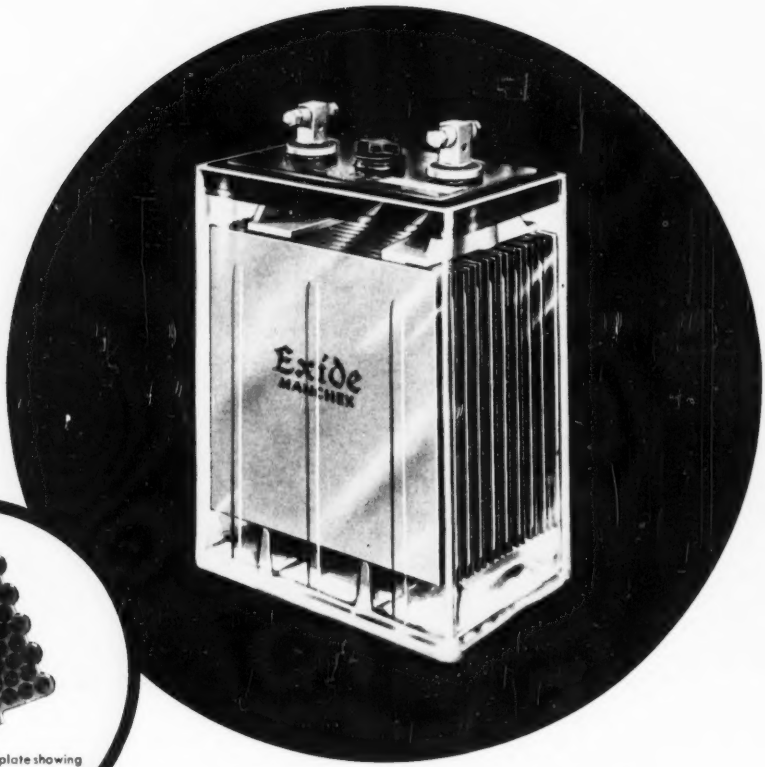
MANUFACTURING



MARINE

CONSTRUCTION

A. E. Brattmar



Exide-Manchex positive plate showing unique lead button construction.

The New EXIDE-MANCHEX Battery

For dependability and economy in SWITCHGEAR SERVICE

You can always count on Exide-Manchex Batteries for dependable, day-in, day-out performance in switchgear operations. They provide improved electrical characteristics, deliver increased power (watt) output per unit of space, and assure long battery life with low cost maintenance.

The many fine qualities of Exide-Manchex Batteries are due chiefly to the manchester positive plate with its unique lead button construction. The buttons, rolled strips of corrugated lead, are pressed into holes of the lead antimony grid. Forming action expands the buttons and locks them securely in place. Only a comparatively small portion of the total lead in the buttons is formed initially into active material; the remainder is available for gradual conversion in service.

Use the new Exide-Manchex Battery for switchgear service, stand-by power and other stationary battery applications. It provides up to 100% more capacity in the same given space.

Exide
BATTERIES
"Exide" Reg. Trademark U. S. Pat. Off.

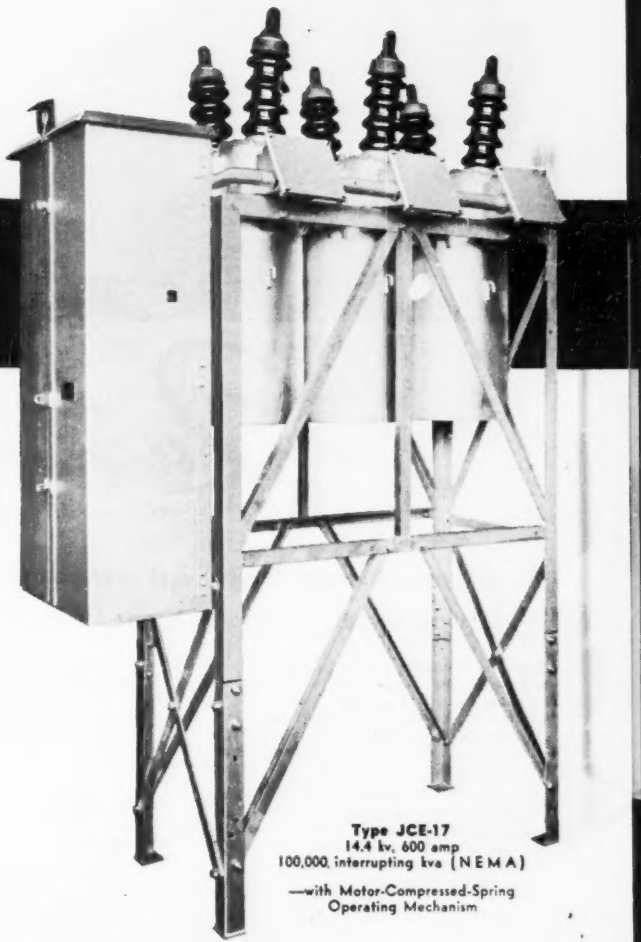
1888...DEPENDABLE BATTERIES FOR 61 YEARS...1949

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • *Exide Batteries of Canada, Limited, Toronto*

Here's the Stored-Energy Mechanism in a 14.4 kv Oil Circuit Breaker

Outdoor Type JCE-17
14.4 kv, 600 amp
100,000 interrupting kva

A Protective Unit with High-Speed, 3-Reclosures, completely tested and assembled . . . ready to operate



Type JCE-17
14.4 kv, 600 amp
100,000 interrupting kva (NEMA)
—with Motor-Compressed-Spring Operating Mechanism

Low Operating Current—The Motor-Compressed-Spring Mechanism uses only a **small** motor to compress the closing spring. May be a-c or d-c.

Simple Tripping Schemes — Though d-c potential trip provides the utmost in accuracy and reliability, many conditions permit use of a-c series trip with or without overcurrent relays. If a-c is used for the spring-compressing motor, the ultimate in simplicity and low cost is attained.

Rapid Arc Extinguishment — The Pacific Electric Mfg. Corporation exclusive Expulsion Chamber extinguishes the arc with a minimum of oil carbonization or effect on contacts.

Get All Facts . .

Conform to AIEE and NEMA Adopted Standards

Calif

PACIFIC ELECTRIC MFG. CORPORATION

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F. W. GORMAN ELECTRICAL EQUIP. CO., P. O. Box 223, El Paso, Texas
14547 Madison Ave., Cleveland 7, Ohio
G. B. KIRKWOOD, 437 S. Hill St., Los Angeles 13, Calif.
ARKANSAS ELECTRIC CO., 316 Louisiana St., Little Rock, Ark.
WILLIAMSON & WILMER INC., 617 Mutual Bldg., Richmond 19, Va.
LEONARD M. SLUSSER, 318 Dooly Block, Salt Lake City 1, Utah

Other Representatives in Principal Cities

Johns-Manville Announces Two New

Smooth layers of Quinterra Type 6 Electrical Insulation (Twin-ply), used in winding a Marcus dry-type transformer

Quinterra

TYPE 6 (TWIN-PLY)

A new cost-reducing, high-temperature insulation that prolongs transformer life many times through its resistance to pyrolysis

Here is a radically new asbestos-base, continuous-sheet, paper-like electrical insulation that offers many economies. It is primarily intended for interlayer and wrapper insulation in windings and coils used in Class A and B transformers (internal hot-spot temperatures 130C, or higher if special varnishes are employed).

Quinterra Type 6 is plied at the factory by welding two layers of Quinterra and calendering them into a dense, strong and smooth-surfaced insulation having good tensile and bursting strengths. For economical application with a minimum of waste, Quinterra Type 6 is furnished in continuous rolls cut to exact widths.

Excellent handling properties

Uniformity of physical and handling properties enables assemblers to achieve production rates such as are attained with the best types of interlayer and wrapper insulations. Further economies result from the large square-foot-per-dollar coverage.

Excellent constructional advantages

The plied construction of Quinterra Type 6 offers two distinct constructional advantages: (1) It provides better dielectric protection than a single layer. (2) Under stress, the weaving strains within coil structures are less likely to damage a plied insulation than a single-layer insulation.

Excellent dielectric-thermal characteristics

The base sheets of all Quinterra products are made 100% inorganic, but, for mechanical reasons only, are saturated with an organic resin. At room temperature (ASTM conditions) Quinterra Type 6 averages in excess of 350 VPM. After prolonged exposure at 175C, long after the thermoplastic saturant is driven off, it still maintains its original dielectric strength and requires only the re-establishment of its varnish protection to provide a further useful life cycle.

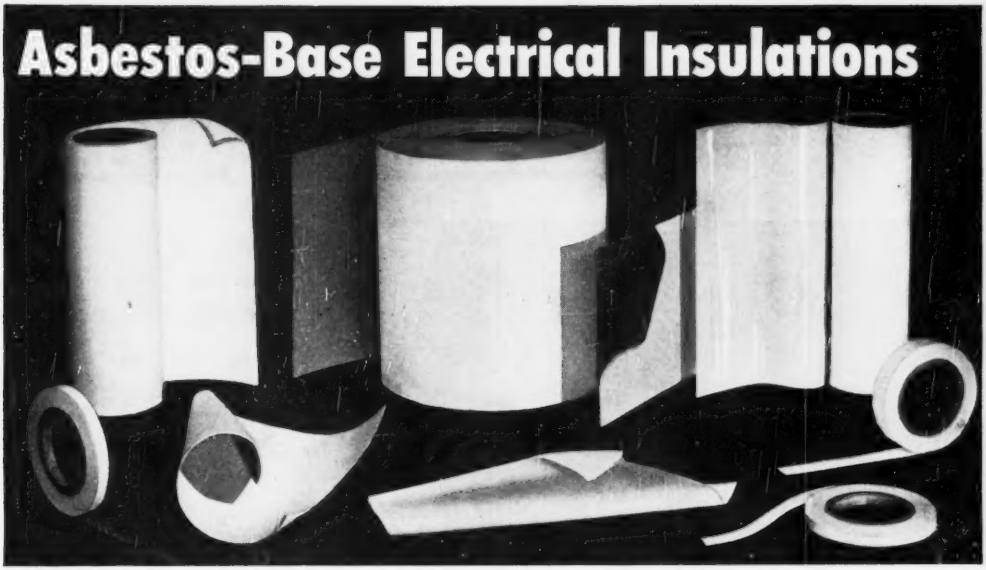
We will be glad to provide you with samples and further information about Quinterra Type 6 Electrical Insulation. Write Johns-Manville, Box 290, New York 16, N. Y.

Weights and thicknesses of Quinterra Type 6

Thickness ± 10%	Weight Per 100 sq ft ± 15%	Approx Coverage sq ft lb
.0045"	2.5	40
.006"	3.3	33
.007"	3.8	26
.008"	4.5	22
.009"	4.8	20
.010"	5.5	18
.012"	6.2	16
.015"	7.2	14

Johns-Manville

Asbestos-Base Electrical Insulations



A variety of types of electrical insulations as produced by combining glass, mica, and organic papers and films with Quinorgo #3000 or #4000.

Quinorgo

#3000 AND #4000

New, economical, high-temperature insulations with a previously unattainable combination of dielectric and mechanical properties

Quinorgo #3000 and Quinorgo #4000 are two new insulations developed by Johns-Manville. Each can be used alone or in combination with other dielectrics. In the latter use they can be either treated or coated with insulating varnishes, or combined with organic or inorganic electrical insulating sheets or films.

Quinorgo insulations contain 80% or more of specially processed asbestos fiber, the remainder being selected organic fibers and binders. The two types differ in that the organic portion of Quinorgo #4000 contains a small amount (3% or less) of resin not present in Quinorgo #3000. The resin slightly reduces absorption and penetration.

These highly improved forms of asbestos electrical insulations have extreme uniformity of texture and caliper (from .005" to .015"). They are furnished in continuous rolls, in tapes of exact widths and in sheets cut to size.

Excellent for compactness — Quinorgo #3000 and #4000 have important advantages where asbestos papers previously could not be used because they were too thick, their dielectric too low, or strength inadequate.

Excellent for "composites" — Quinorgo #4000, because of its heat resistance, closed nonwoven structure, uniform thickness and special penetration characteristics, is ideal for use in composite insulations.

For example, it may be coated on one surface with shellac or varnish to permit bonding or cementing to it such mechanically or dielectrically stronger materials as inorganic woven cloths and mica or organic cellulose films or sheets. The opposite surface remains ready for absorption of treating varnishes used in the further processing of equipment after the composite insulation has been applied.

Excellent for economies—Quinorgo #3000 and #4000 may be economically substituted for quality grade organic or inorganic layer insulation. When varnish-protected in apparatus, they will perform indefinitely because of their high asbestos content. (Hot-spot temperatures to 130C).

We will be glad to provide you with samples and further information about Quinorgo insulations. Write Johns-Manville, Box 290, New York 16, N. Y.

General average properties of Quinorgo #3000 and #4000

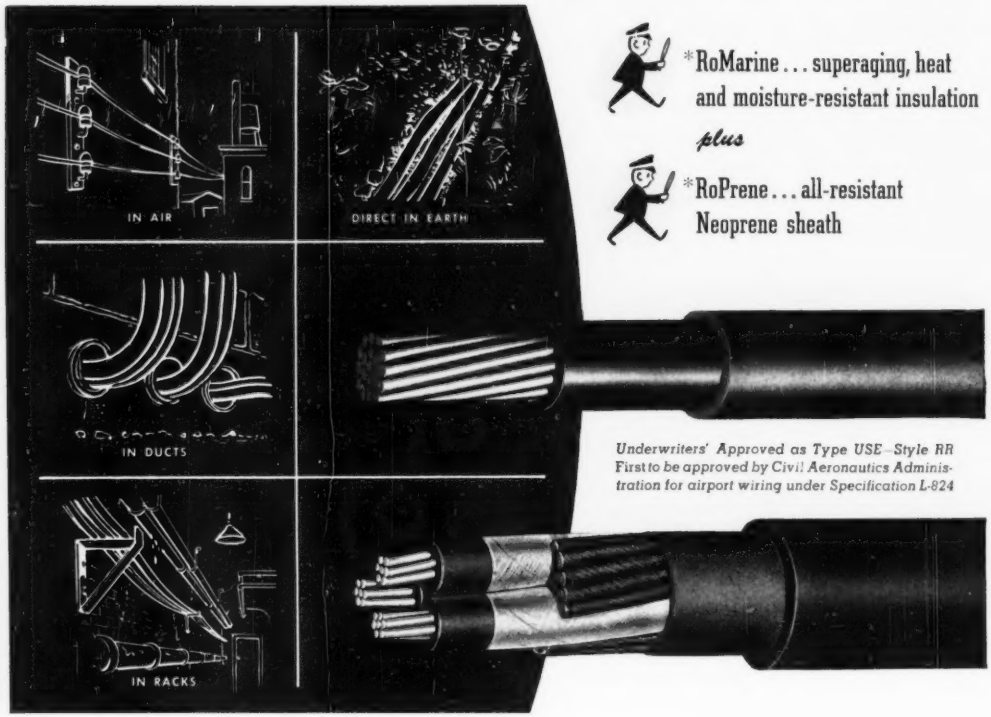
Thickness	Lbs Per 100 sq ft	1" wide Longitudo T.S. lbs	Dielec Min VPM
	3000-4000	3000-4000	3000-4000
.005"	1.5 1.7	14 15	300
.007"	2.2 2.5	18 19	300
.010"	3.3 4.0	20 21	250
.015"	4.7 5.7	26 28	200

Electrical Insulations

JOHNS-MANVILLE JM PRODUCTS

You get Double* Protection

with RoMarine - RoPrene



*RoMarine . . . superaging, heat and moisture-resistant insulation

plus

*RoPrene . . . all-resistant Neoprene sheath

Underwriters' Approved as Type USE—Style RR
First to be approved by Civil Aeronautics Administration for airport wiring under Specification L-824

RoMarine-RoPrene enjoys its high popularity as a dependable power cable with good reason. It offers *double protection* against circuit failures. First, its RoMarine insulation is both heat and moisture resistant. Second, its RoPrene sheath is highly resistant to oils, acids, corrosive fumes and flame. It is unaffected by electrolysis, weather hazards or extreme temperature change.

Add to this, versatility of application and you can understand why more and more utilities and industrials are swinging to RoMarine-RoPrene, the all-purpose cable. Installed direct in earth, in conduit, in air, or in runs combining all three, RoMarine-RoPrene is ideal for secondary networks, underground entrances, street lighting, station control circuits, or general purpose wiring. It is cheaper than lead sheathed cable. It is lighter . . . easier to handle and splice . . . Write for Specification RR-1 for test data and construction details.

It Costs Less to Buy the Best . . . Buy Rome Cable

ROME CABLE CORP., Dept. EW-12, Rome, N. Y.
Please send me Specification RR-1 (Test Data).

Name .....

Company .....

Address .....

City ..... *State*

ROME CABLE
Corporation
ROME • NEW YORK
From Bar to Finished Wire

ROME CABLE ROME, N.Y.

fewer replacements
+
less maintenance
+
maximum performance

=a MUST in your planning

LAPP LINE POST

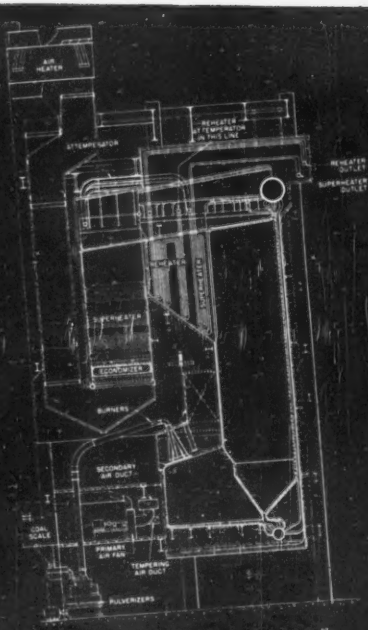
INSULATOR failures cost you: unit replacement + maintenance labor + possible loss of revenue through outage + strained consumer relations. Actual PERFORMANCE records of installations over the past eighteen years show *in every case* that *lines on Lapp Line Posts have fewer outages, require fewer replacements and less maintenance than comparable lines on any other type of insulator.* Rugged punishment-takers, Lapp Line Posts have a *proved record* of only 1% to 10% the replacement rate on pin type insulators, because:

- If severe flashover or rifle attack breaks off a petticoat or two, the body itself does not crack; leakage and flashover distance are lowered only negligibly. *The insulator remains in fully effective service!* (Contrast with the fragility of shell-type insulators, and the fact that loss of a single shell costs 35% or more of their electrical characteristics.)
- Rugged one-piece construction makes it *impossible* for Lapp Line Posts to crack under tension caused by relative thermal movement—a common reason for failure in multi-part insulators.
- Lapp Line Posts are self-cleaning, eliminating maintenance, increasing efficiency.

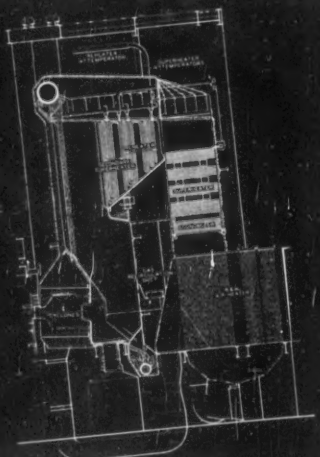
For dependable service, punishment-absorbing durability, maximum PERFORMANCE—all adding up to economy—no other insulator can match the *proved* record of Lapp Line Posts. Put them to work for you. They'll be yours for life.

PERFORMANCE IS PROOF

Lapp INSULATORS

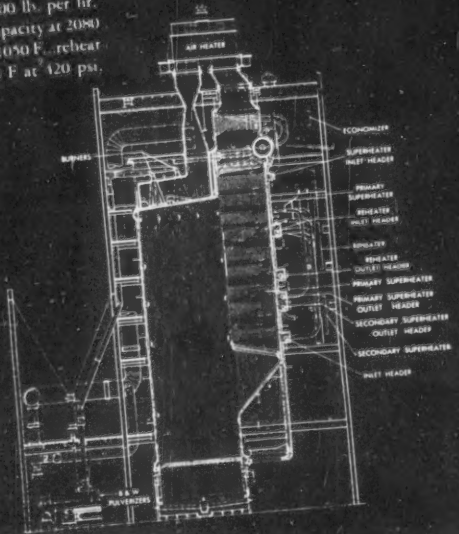


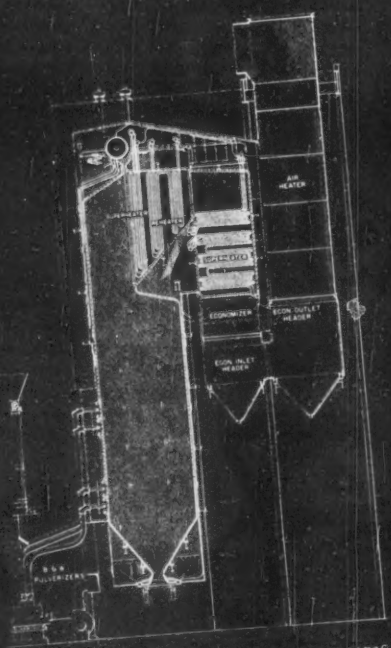
B&W Radiant Boiler of 656,000 lb. per hr. steam capacity at 1490 psi and 1000 F...reheat to 1000 F at 385 psi.



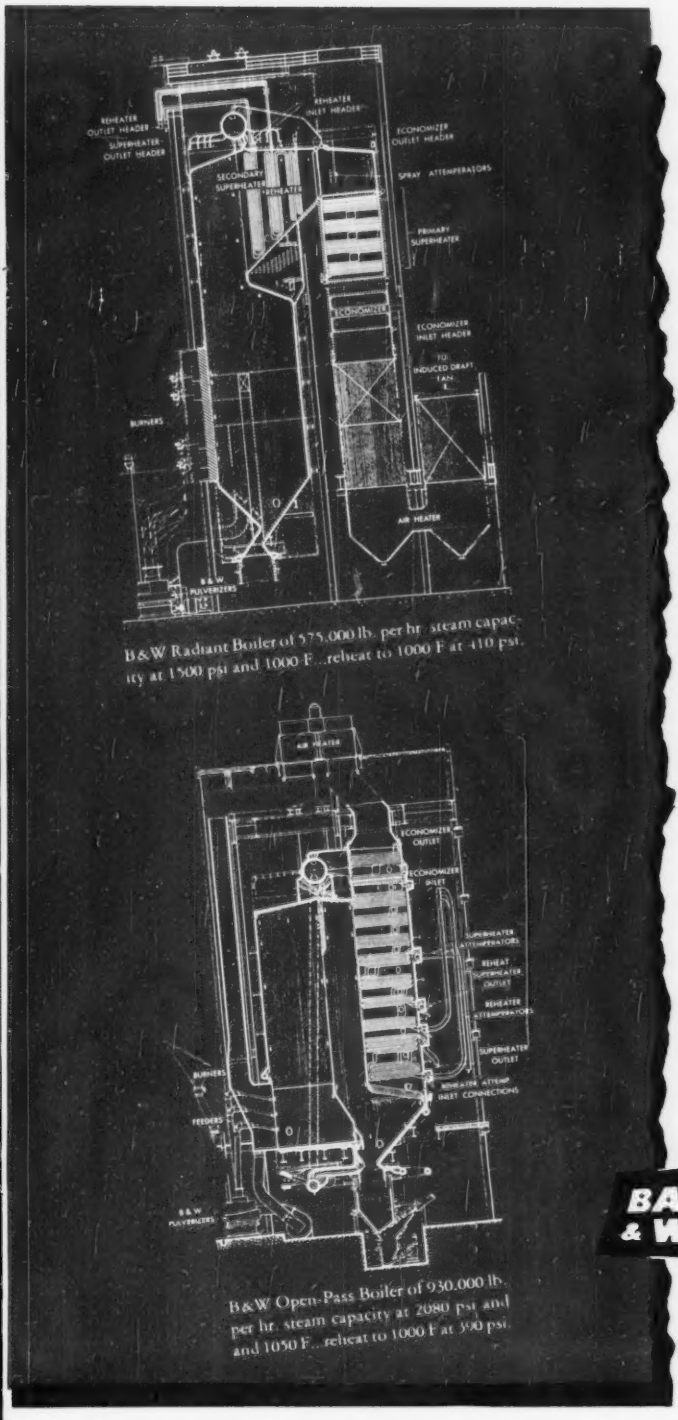
B&W Radiant, Cyclone-fired Boiler of 850,000 lb. per hr. steam capacity at 1850 psi and 1010 F...reheat to 1010 F at 530 psi.

B&W Radiant Boiler of 930,000 lb. per hr. steam capacity at 2080 psi and 1050 F...reheat to 1000 F at 420 psi.





B&W Radiant Boiler of 690,000 lb. per hr. steam capacity at 1480 psi and 1000 F...reheat to 1000 F at 385 psi.



NEW REHEAT CAPACITY

with B&W STEAM

Today, with renewed interest in reheat strong among many power companies, B&W leadership in providing the most economical boiler designs incorporating reheat continues. For example, four identical B&W reheat units—the largest ever ordered—will comprise the largest new all-reheat station in this country. A fifth unit, of the same characteristics, is on order for another station in the same system.

Whether your current interest is in reheat or in the conventional superheat boiler, it will pay you, as it has so many other utilities, to consult B&W early in your plans for additional capacity or an entirely new plant.

B&W

BABCOCK & WILCOX

G-468

J-D

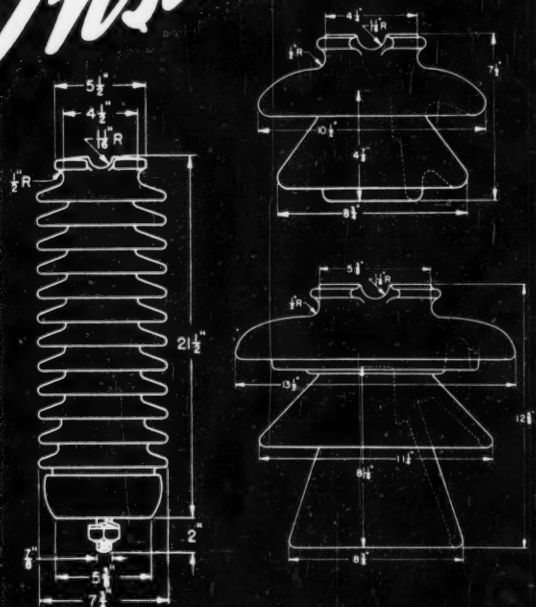
One piece porcelain design

Multi-part porcelain design

Write for Bulletin No. 500

★ ★ ★ ★ ★

HIGH VOLTAGE PIN TYPE AND LINE POST *Insulators*



JEFFERY-DEWITT INSULATOR CORP.

Kenova, West Virginia, U.S.A.

★ ★ ★ ★ ★ ★ ★ ★

Approved by UNDERWRITERS LABORATORIES

YES, the PENN-UNION Connector TAKES THEM ALL-

LARGER SURFACES for the WRENCHES ~ a good-sized HEX Top and Bottom

The men who use connectors appreciate the *better design* of the Penn-Union - - especially when they have to make a splice in close quarters, or any unhandy location.

Better Design is a feature of the entire Penn-Union line, which includes Tees and Taps, Straight Connectors, Terminals, Grounding Clamps, and many more fittings . . . every one thoroughly dependable, mechanically and electrically. *Preferred by leading users,* who have found that "Penn-Union" on a fitting is their best guarantee of unfailing service.

Far More in use than any other

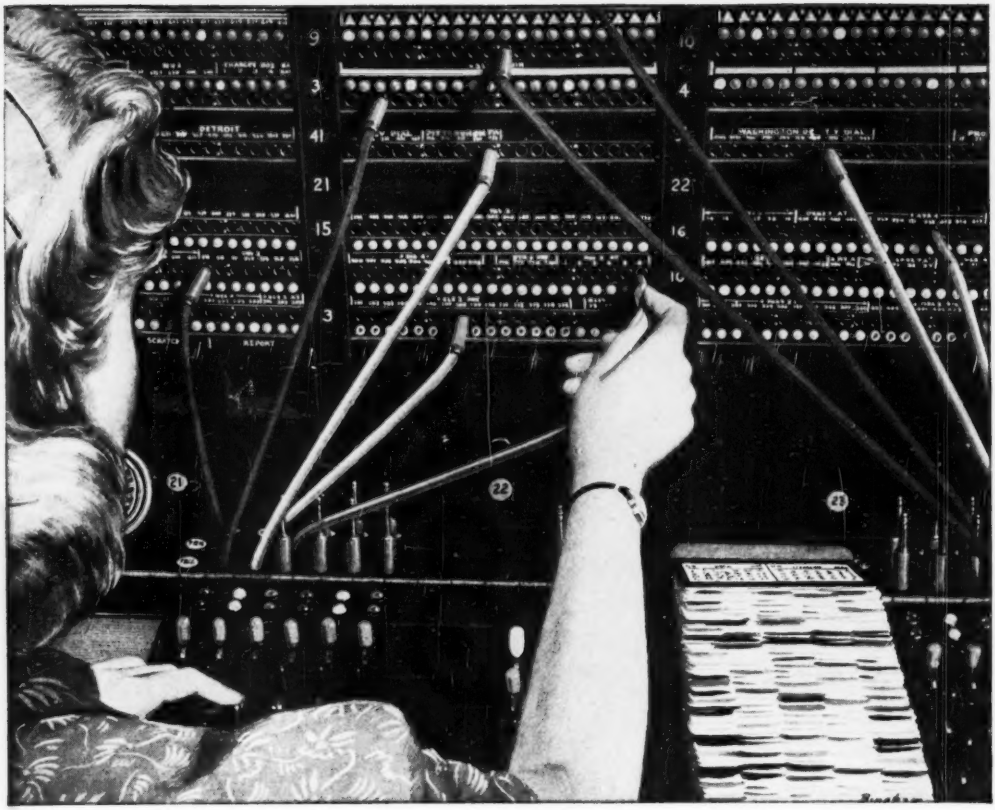
Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORPORATION, Erie, Pa.

Canada: Dominion Cutout Company, Ltd., 250 Richmond St. West, Toronto

The Complete Line of Conductor Fittings

PENN-UNION



What's the connection?

TO give you good service, your Bell Telephone company must have good switchboards, cables, telephones, and literally thousands of different types of equipment. Each must be *designed*, then *manufactured*, so that all can *operate* together perfectly in carrying your voice quickly and clearly across the street or across the nation.

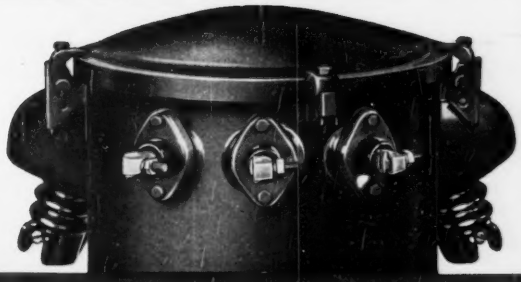
Do you know Western Electric's connection with all this? For sixty-seven years, we have been the manufacturing unit of the Bell System. This has assured a dependable source of good equipment—efficiently and economically produced to meet the needs of telephone users.

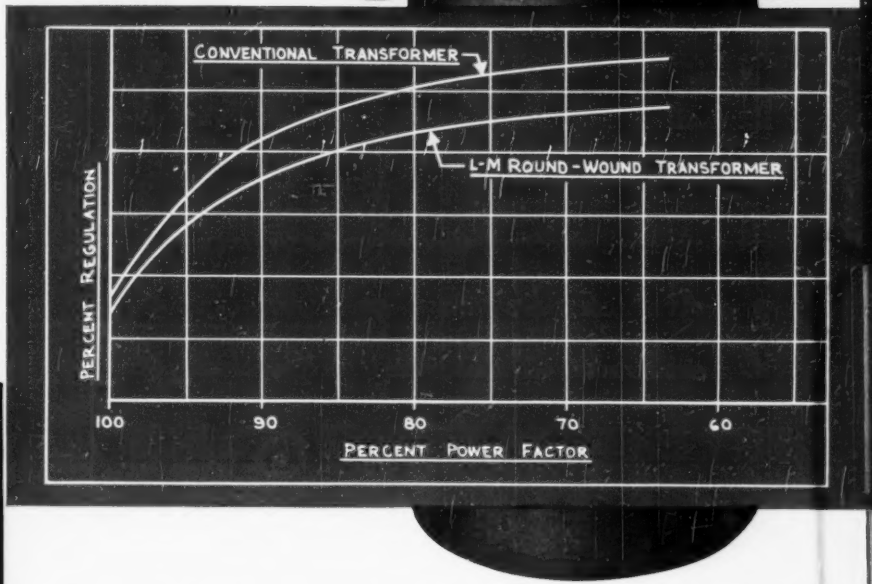
• As members of the Bell System, Western Electric people who *make* equipment, Bell research people who *design* it and Bell Telephone company people who *operate* it all work together with one aim: Good telephone service for you at the lowest possible cost.

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

"Better regulation at all power factors..."

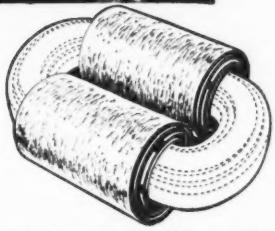




ROUND WOUND

Robert P. Thompson,
Transformer Design Engineer,
Line Material Company,
Zanesville, Ohio

a major advantage of L-M ROUND-WOUND transformers," says ENGINEER THOMPSON



Continuous wound core, which is never cut, unwound, or disturbed in any way after annealing, because the long round coils are wound directly onto the core by L-M's ingenious Round-Wound method.

"There's no patent on designing good regulation into a transformer," says Mr. Thompson. "The problem is to get good regulation *without* sacrificing other desirable characteristics, *and* without increased cost to the user.

"We are able to solve the problem with our wound core which is not cut, unwound or disturbed in any way after annealing, resulting in uniformly stable core loss and low exciting current. The compact cruciform cross section shape of the Round-Wound core enables the designer to use long round coils with fewer turns and smaller mean turn diameter, thus gaining lower resistance and reactance values. Uniformly low impedance with improved regulation at all power factors—both recognized features of real significance under today's operating conditions—are outstanding features of the Round-Wound transformer."

Want to know more about the savings "Round-Wounds" offer the utility company? Want to know more about how L-M Round-Wound transformers are designed, why they give "Balanced Performance" and operating benefits to the user, better service to the customer? Ask the L-M Field Engineer for this fact-packed bulletin No. 16-G-1, or **write Transformer Division, Line Material Co., Zanesville, Ohio.**

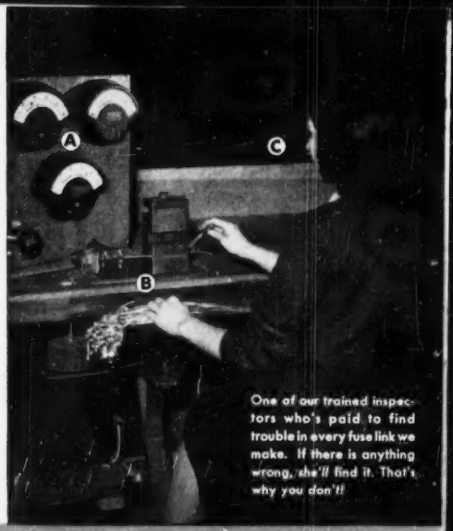
LINE MATERIAL Transformers

Complete Coordinated Equipment For All Distribution Requirements

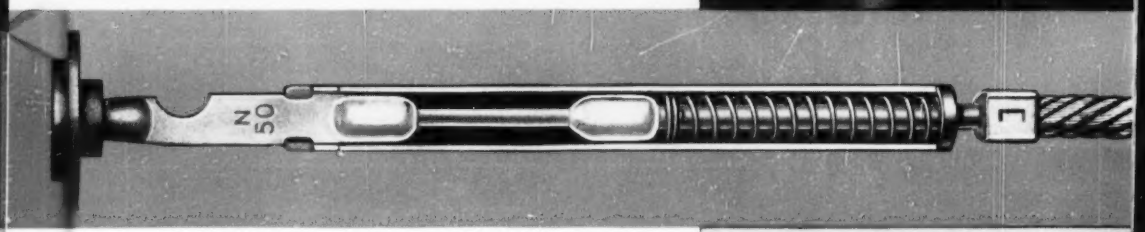
LM

She bets we'll be wrong... in either case, YOU WIN!

Every L-M UNIFIT FUSE LINK is individually tested



One of our trained inspectors who's paid to find trouble in every fuse link we make. If there is anything wrong, she'll find it. That's why you don't!



One bad apple may spoil the barrel. One bad fuse link could make a lot of trouble for our customers. So, to assure complete reliability, we test every individual L-M fuse link. Not one in a thousand, not spot checking, but *every one*, gets the "works." Tested for accuracy! Tested for coordination! Tested for strength, and mechanical construction!

We think L-M is the only fuse link manufacturer giving 100% inspection. It takes more work—sure—but that's why L-M links have such an enviable reputation for accuracy—especially among men to whom precise coordination is important. For details on L-M's very complete line of fuse links, ask the L-M Field Engineer or write *Line Material Co., Milwaukee 1, Wisconsin.*

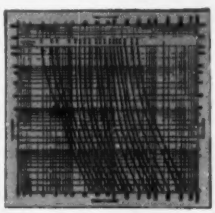
Fuse Coordination your problem?

In addition to making our fuse links so they will coordinate, we have developed a fairly complete manual on Fuse Coordination. Men who have used it have been very complimentary about it. If *you* have a fuse coordination problem and would like a copy, drop us a note.

*Only L-M can give you a link like the one shown above! This is a 50-amp spring type link in die-cast construction, an L-M exclusive process!

Here's what our inspectors check:

(A) Accuracy of Rating for Precise Coordination:
Every link must coincide closely with the melting and clearing time curves. Millivolt tests show whether the link is accurate. If not, out it goes—to the scrap pile, *not* to the customer. That's why you can depend on L-M links for coordination.



(B) Pull Test:
NEMA specifies a 10 pound test so that links won't pull apart needlessly under cutout tension. Ours pass that test with a good margin of safety—or you never get them!

(C) Physical inspection:
To weed out any other possible faults. Every L-M link gets a pretty critical once-over—it's gotta be good!

LINE MATERIAL Fuse Links

Complete Coordinated Equipment for All Distribution Requirements

L-M Engineers give you this

FUSE CUTOUT BUYER'S GUIDE

and a good example—the

L-M "PVD"

L-M designed the first wet-process porcelain cutout box on the market—more than 20 years ago, and has been the leader in fuse cutout development. Here, according to L-M engineers, is what it takes to *make a good* fuse cutout.

A cutout must keep itself *cool and dry*, so as to keep oxidation and deterioration of the cartridge to a minimum. Openings and leads should keep out rain so the cutout stays dry inside.

Contacts and contact areas should be large, with ample current carrying capacity, and preferably silver-plated. There should be a minimum number of electrical joints.

The cutout should have generous electrical clearance and creepage distances.

For ample rupturing capacity, the cutout should have free venting and a strong tube; and the tube should be securely anchored against recoil.

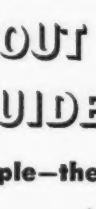
In a drop-out cutout, link parts should be well separated before the tube drops, so that the arc is cleared in the tube.

It is desirable to pull link parts straight out, as friction around the end of the tube will slow up the action.

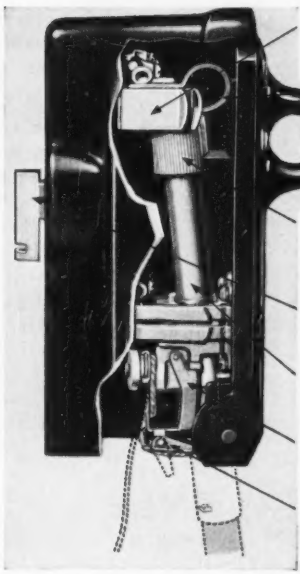
Finally, the cutout must be simple to install. Re-fusing should be simple, and easy, even with gloved hands, to keep outages at a minimum.

GET THIS BULLETIN!

Quick reference to principal L-M open and closed cutouts: ratings, sizes, hangers. Ask the L-M Field Engineer for a copy or write Line Material Co., Milwaukee 1, Wisconsin.



DETAILS SHOW HOW "PVD" BENEFITS USERS



Large upper and lower contacts stay cool. Heavy reinforced silver-plated copper U straps; large contact areas.

Vertical Contact Spring: spring-tempered Monel, with silver-plated copper shunt; this spring helps push tube down, follows it part way to give extra clearing time; acts as top recoil absorber.

Large Knurled Cap, silvered, clamps fuse link button firmly into upper cartridge-ferrule. Easy to grasp for re-fusing.

Bracket Stud firmly cemented into the porcelain, not bolted through, to prevent corona and radio noise.

Heavy "Bakelined" Tube: the Bakelite prevents warping; the fibre lining extinguishes the arc.

Latching Lever holds tube in place; tube *cannot* drop till after link has been flipped out of the tube.

Link Flipper and Spring: puts only 4 pounds pull on link. When link blows, flipper pulls it straight down out of tube—especially important in interrupting light fault currents. When flipper is down (dotted line) it releases latching lever, permitting tube to drop.

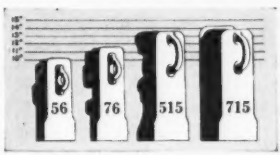
It signals: the tube is coated with canary yellow plastic; when it drops it is easily seen from the ground—saves "hunting".

DOOR STAYS CLOSED

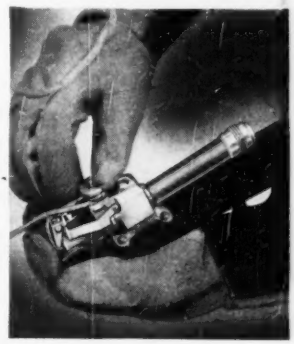
"PVD" is the original drop-out cutout on which the door stays closed, even after the link blows. This keeps out rain and sleet; the current carrying parts and the inside of the box stay dry, which prevents internal flashover. What's more, sleet on the door does not affect the drop-out operation of the "PVD".

"PVD" FAMILY PORTRAIT

"PVD's" meet (nearly) all distribution requirements for closed cutouts.



The 50 amp "PVD'S"	The 100 amp "PVD'S"
"PVD" 56 5 kv, 10⅛" high	"PVD" 515 5 kv, 13¾" high
"PVD" 76 7.5 kv, 11⅜" high	"PVD" 715 7.5 kv, 14¼" high



ONE MINUTE RE-FUSING

Door is unhooked and re-fused in 60 seconds or less. Big knurled knobs, easy to handle even with gloves.

Or 6-second re-fusing

Lineman just opens the door, lifts it off, and hooks on a spare fused door. "PVD" Bakelite doors are interchangeable—you save time when restoring outages.

LINE MATERIAL Fuse Cutouts and Fuse Links

LM

Complete Coordinated Equipment for All Distribution Requirements

7087A

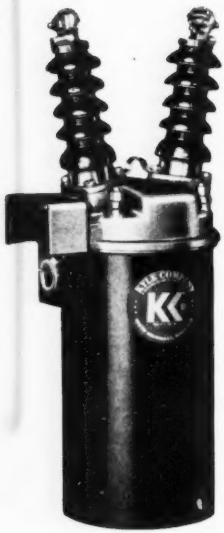
KYLE automatic oil circuit RECLOSERS for precise coordination . . .

Kyle reclosers offer complete protection for lines, and safety for linemen. They are the original, and still the best, automatic protection for both single and three-phase lines. They offer flexibility to meet all conditions, and precise coordination with fuses, sectionalizers, other reclosers, and station breakers. They avoid lockouts and outages, cut maintenance, and protect your equipment and service.

Outstanding Kyle Recloser Features

Three reclosures before locking out; choice of four opening sequences . . . Coils and sequences easily changed in the field . . . Trip-free operating handle. Tank and cover are dead; bushing terminals are the only live parts . . . Positive dependable operation—no motors or clockwork . . . Large cast aluminum cover; sleet hood protects operating handle and counter . . . Ratings 5 to 50 amps.; 2400 to 15,000 volts; minimum tripping current 10 to 100 amps.; interrupting capacity 150 to 1200 amps.

. . . ON SINGLE-PHASE . . . AND THREE-PHASE LINES

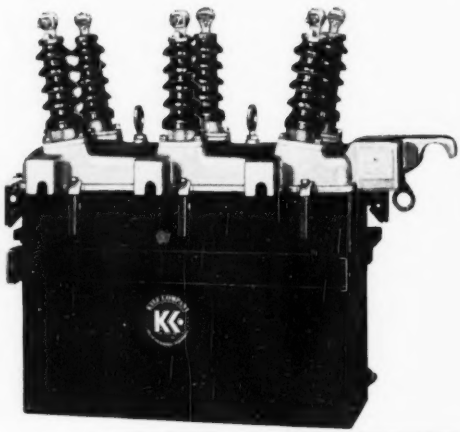


KYLE
TYPE H
Single-phase recloser

Protects feeders and branch lines on both single- and three-phase systems by coordinating with fuse links, sectionalizers, and other reclosers. Isolates permanent faults to small parts of a system and thus cuts amount of patrolling required.

KYLE
TYPE 3H
Three-phase recloser

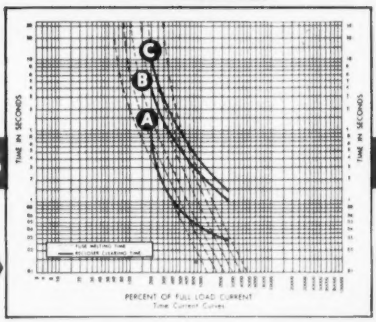
A practical combination of single-pole units so as to permit single-phase operation of any of the three-phase units so long as no lockout is required. If any one unit locks out, the other two lock out simultaneously. Prevents "single phasing" and overloading and burning out 3-phase motors. 7119



CHOICE OF 4 OPENING SEQUENCES

Curves show recloser action on each sequence:

1. Curve A—four fast openings.
2. Curve A and B—two fast, two retarded openings.
3. Curve C—four extra retarded.
4. Curves A and C—two fast and two extra retarded.



LM KK

For complete information ask the L-M Field Engineer or write **KYLE COMPANY** division of Line Material Company Box 2077, Milwaukee 1, Wisconsin

LINE MATERIAL Kyle Reclosers

Complete Coordinated Equipment for All Distribution Requirements

7119

KYLE OIL SWITCHES

for manual or remote control of

shunt capacitors, street lights, airport lighting, flood and other outdoor lighting, many other uses

100 AMPS., 15,000 VOLTS

Kyle manual (type G) and remote control (type GR) oil switches are sturdy, dependable, and provide many features that make them preferred for a wide variety of light duty load-break operations.

Quick break . . . long contact life

Both the manual and motor driven switches provide quick-break operation. Double copper-tungsten contact tips are specially designed to minimize burning and pitting, assuring long life.

Both are light weight, easy to install, and their cost is moderate. They are safe to use. Mechanism is insulated from the tank. Head and operating handle are dead, the only live parts being the top bushing terminals.

Dependable Motor Drive

The type GR has a shaded pole motor with a 115 volt 60 cycle AC circuit with a selector switch to open and close the GR from a remote point. It may be operated manually if desired. The switch uses current only during the actual on or off operation. There are no magnets or coils requiring continuous current. Three single-phase type GR switches may be used to give simultaneous switching of three-phase circuits. Other than an annual oil change and inspection, these switches require no attention and give long, dependable operation within the recommended operating cycles.

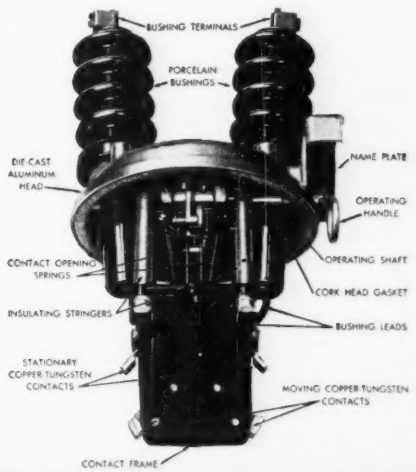
L-M'S COMPLETE OIL SWITCH LINE

Complete description, ratings, and dimensions in this handy Bulletin CR-2. Ask the L-M Field Engineer for a copy or write:

KYLE COMPANY
division of Line Material Company
Box 2077, Milwaukee 1, Wisconsin

Type GR Motor Driven Remote Control Switch

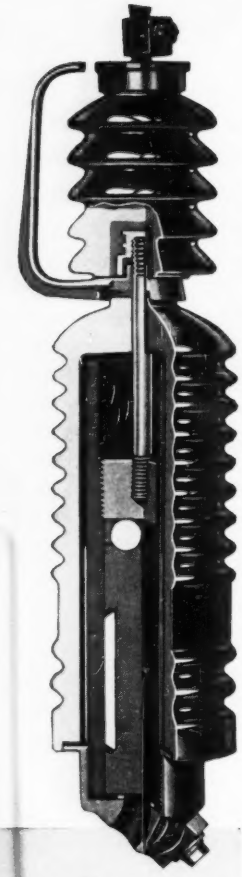
The manually operated type G looks the same except that it does not have the separately encased motor control mechanism shown on the left side. Total height, 18½"; tank 7⅛" diameter. Hangers for direct pole or cross-arm mounting.



7121

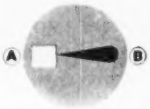
LINE MATERIAL Kyle Oil Switches

Complete Coordinated Equipment for All Distribution Requirements



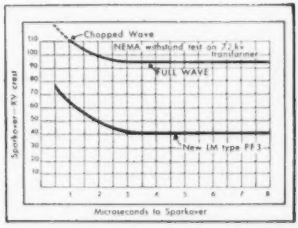
The arc that blows itself out

It's an old gag to a type PF arrester—but an arc will fall for it every time! The low sparkover distances at *A* trap the arc into a tight spot in the wedge-shaped fibre arcing chamber. The arc forms gas that blows it into a long arc at *B*—and blows it right out of the bottom vent with a bang! Works like a charm—without fail—in a half cycle or less! The arc doesn't stay at *A* long enough to burn the center electrode—so the arrester doesn't get hurt in the process. Better get the whole story—in this new **Bulletin LA3. Ask the L-M Field Engineer for a copy or write Line Material Co., Milwaukee 1, Wis.**



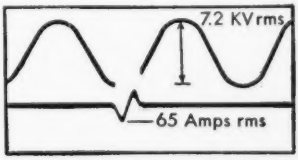
LM's new type PF3 Expulsion Arrester

Gives you lower impulse sparkover . . . greater transformer protection



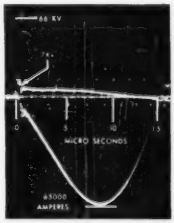
Curves at right show critical sparkover values of a 9 kv L-M PF3 arrester, compared with the minimum impulse strength of a 7200 volt transformer required by NEMA standards. Plenty of safety margin here!

PLUS prompt interruption of follow current



Under extremely heavy lightning surges the expulsion action is so effective that the arc is blown out and follow current interrupted almost before it starts. Oscillogram shows 65 amp follow current drawn for .1 cycle with a 35000 ampere surge on a 7200 volt line with 1200 amps fault current capacity.

No limit on capacity . . . Long life



While the oscillogram shows only the NEMA-standard 65000 amp discharge test, obviously the PF3 is designed to meet this test with an ample margin of safety. ● There is no limit to the system capacity on which the PF3 may be used. ● The arc switching feature virtually prevents burning of the electrodes, assuring long life for the arrester with no appreciable increase in sparkover values.

Many Features You'll Appreciate

Heavy wet process porcelain housing with ample leakage distances . . . heavy external gap . . . Umbrella-type rain-shield is moisture-sealed above and below with heavy resin-coated gaskets . . . strong clamp-type terminals . . . Horn-fibre tube and fibre plug with wedge-shaped arc-switching chamber . . . choice of flat or cross-arm mounting hangers. In 3, 6, 9, 12, and 15 kv sizes.

LM

LINE MATERIAL Lightning Arresters

Complete Coordinated Equipment for All Distribution Requirements

throw away your paint brush

get ELEMEX capacitors in Stainless Steel tanks

. . . with L-M "Lifetime" solder-sealed bushings

. . . in 15 and 25 kvar sizes in standard voltage ratings

. . . LOW UNIT STRESS for long service life

One utility company estimates that it costs $8 per unit to repaint capacitors. *Whatever* it costs is *too much*—when you can get *good* capacitors like ELEMEX in *stainless steel tanks!* And that's not even considering all their other advantages. They're pretty swell jobs; we think it would be worth your time to take a good look at them!

Stainless steel tanks mean no painting, ever! They also mean that the lineman doesn't have to take time to scrape paint to get a good ground. Tanks are "Hydis" treated—for good heat dissipation.

OTHER ELEMEX ADVANTAGES

Uniform terminal elevation—another time-saving feature. The 15's and the 25's have the same terminal elevation above the hanger in each voltage class. No change in leads when you replace or mix 15 *kvar's* with 25's. The 25's are 5¼" longer *below* the hanger, so they're easy to identify from the ground. All sizes same width and thickness, fit same hanger bolts.

"Paragroove" Connectors, another L-M "first": wire is just dropped in and clamped; no crossing of leads, no loose parts. **L-M "Lifetime"** solder-sealed bushings keep air out, keep ELEMEX liquid in—permanently.

Low unit stress: conservative design assures long life. **Safer:** discharge resistors across every pack or parallel group of packs. **Individual Testing** of packs, tanks and completed capacitor before, during, and after impregnation assures uniformity, long life.

Continuous individual evacuation, drying, and capillary impregnation with ELEMEX non-inflammable dielectric assure precise control of power factor and capacitance—an exclusive L-M research development.

ELEMEX capacitors have an outstanding 5-year service record . . . negligible rate of failure . . . *not one* leaky bushing . . . and thanks to the L-M braced sealed carton, only one has broken in shipment! A good record, don't you think?

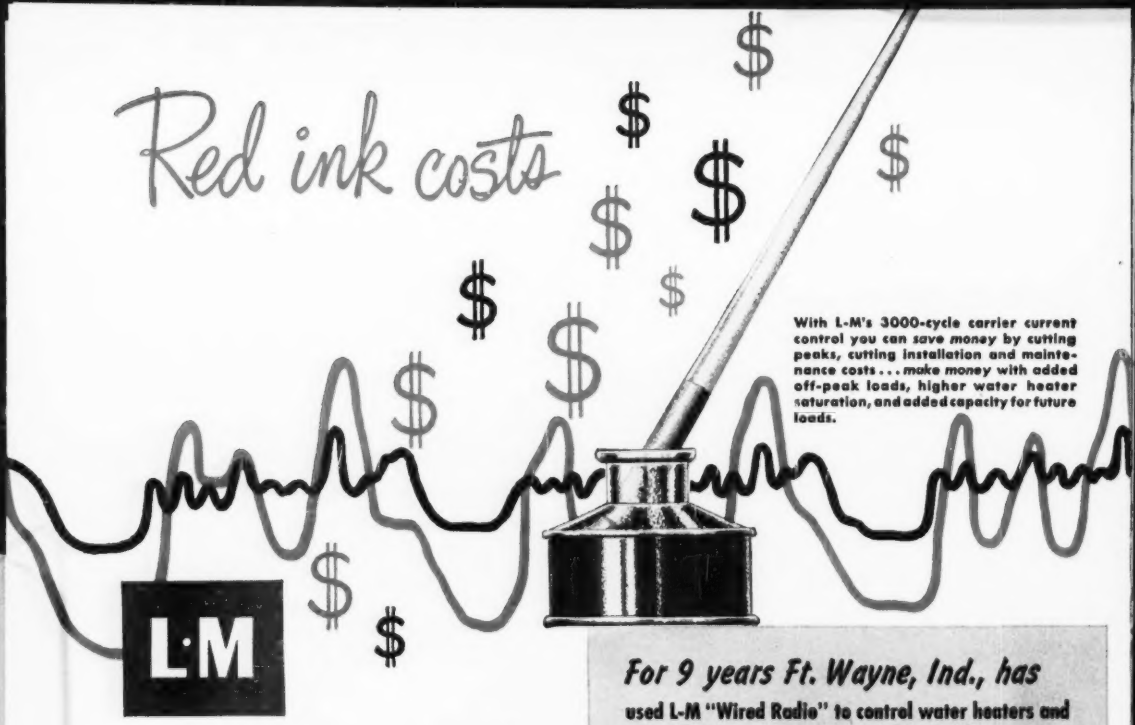
WANT MORE INFORMATION?

Want details on ELEMEX? Data on capacitor application, uses, savings, power factor calculation? L-M's engineering staff will be glad to help you. **Ask the L-M Field Engineer** to get you the information you need, ***or write*** **Line Material Co., Milwaukee 1, Wisconsin.** 6983

LINE MATERIAL Capacitors

Complete Coordinated Equipment for All Distribution Requirements

Red ink costs



With L-M's 3000-cycle carrier current control you can *save money* by cutting peaks, cutting installation and maintenance costs . . . *make money* with added off-peak loads, higher water heater saturation, and added capacity for future loads.

L·M

"wired radio" control

HELPS YOU STAY IN THE BLACK

L-M "Wired Radio" provides simple, prompt push-button control of any of six different types or groups of loads. There are no pilot wires, no tubes to burn out, no interference; operation is flexible and dependable; maintenance extremely low. It usually pays for itself in 3 to 5 years.

"Wired Radio" controls street and other lighting; water heaters; pumps; supervisory and capacitor switching; signal systems; and other loads, singly or in any desired groups.

Pushing the button automatically sends a 3000-cycle coded signal over your entire 60-cycle system. This signal selects the desired load group and turns it on, or off. Loads may be added whenever off-peak periods develop, or dumped quickly in an emergency.

Ask the L-M Field Engineer to explain the possibilities of "Wired Radio" on your system . . . or write "Wired Radio" division, Line Material Company, East Stroudsburg, Pennsylvania.

For 9 years Ft. Wayne, Ind., has

used L-M "Wired Radio" to control water heaters and street lights. Better than 99.99% perfect operation.

"Wired Radio" Control Unit on a water heater installation

Six kva 6 group transmitter and 3000-cycle generator in the power house at Ft. Wayne, Indiana. Controls about 3500 water heaters and 7000 street lights. Two groups are used for water heaters, 3 for subway and viaduct, downtown, and outlying street lights; the 6th controls decorations during Christmas holidays. The system has made a substantial reduction in peak demand — there has been no interference; maintenance has been low.

7285

LINE MATERIAL "Wired Radio"

Complete Coordinated Equipment for All Distribution Requirements

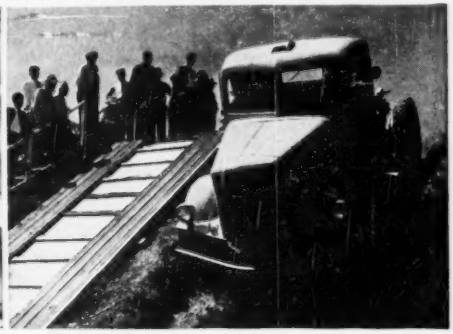
PROOF - *not Guesswork*

Makes FWD America's Foremost Heavy-Duty Truck

Here's actual operating proof by one of the nation's leading utilities. This FWD line maintenance unit is descending a steep grade in reverse on its way to location. What's more, it's doing the job under complete control. Yes — FWD Trucks give you the combined assurance of four-wheel-drive control and smooth, positive braking action. You can be sure of this even before you buy, because FWD Built-to-Code Units are scientifically tested on the FWD proving ground to come to a full stop on a 60% dirt grade. *No wonder over 200 of the nation's top utilities use FWD Four Wheel Drive Trucks—with individual fleets up to 192 units!*

WHAT FWDs DO ON THE PROVING GROUND
1 Highball over hilly curved roads!
2 Slog thru mud — up to the bumper!
3 Speed over 100-ft. unbanked circle!
4 Twist over ditches —18 inches deep!
5 Drive up 6% grade thru 3-ft. of sand!
6 Climb 70% grade from dead stop!
7 Climb 8-in. beam from standstill!
8 Drill pole holes to prove equipment!
9 Speed safely over level highways!

This is FWD's proving ground. This is your assurance that the FWD you select has the stamina to insure long life without expensive mechanical breakdowns.



An FWD "parks" on a 60% dirt grade at the proving ground. For all the facts about FWD Built-to-Code Units, see your Graybar distributor — or write FWD.

An Invitation To Truck Buyers

We invite you to watch FWDs pass a series of rigid performance tests. Ask your FWD distributor to arrange your visit to our plant. Or — if you can't get away, ask him to show you the movie, *The FWD Story*. In either case, you will see for yourself how FWD trucks can help solve your heavy-duty trucking problems.

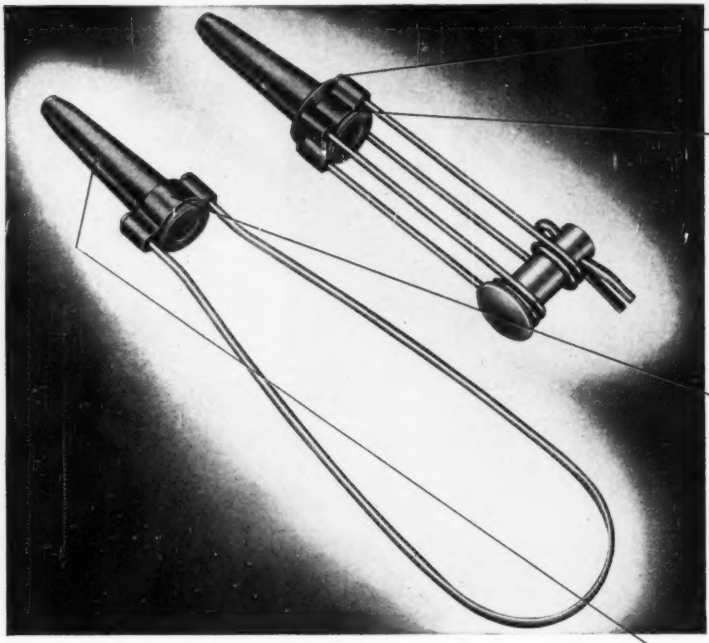
Walter A. Allen
President
The Four Wheel Drive Auto Company

THE FOUR WHEEL DRIVE AUTO COMPANY
Clintonville, Wis. • *Canadian Factory:* Kitchener, Ontario
FOUR AND SIX WHEEL DRIVE TRUCKS

U-3

America's Foremost Heavy-Duty Truck

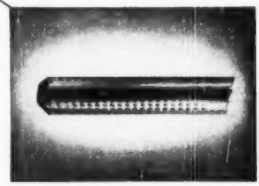
Accents on Accuracy



1. Full strength of bail is realized by tool design that flows steel smoothly into head, strengthening the grain structure.

2. Close control of bronze yoke insures sufficient bearing area against headed bail.

3. Tubing is not only held closely to size, but also to smooth inside finish, because folds or occlusions might hamper perfect performance.



4. Tapers of jaw and tube are accurately limited so wire is not pinched sharply where it enters jaws. This prevents fatigue breakage of wire.

in the manufacture of

STRAIGHTLINE DEADENDS

Here is a line of truly corrosion resisting deadends—products that will really last in any climate—at prices no higher than ordinary galvanized fittings. It takes accuracy of manufacture plus ingenuity and economy of design to use the best materials available regardless of cost and make a superior product at a competitive price.

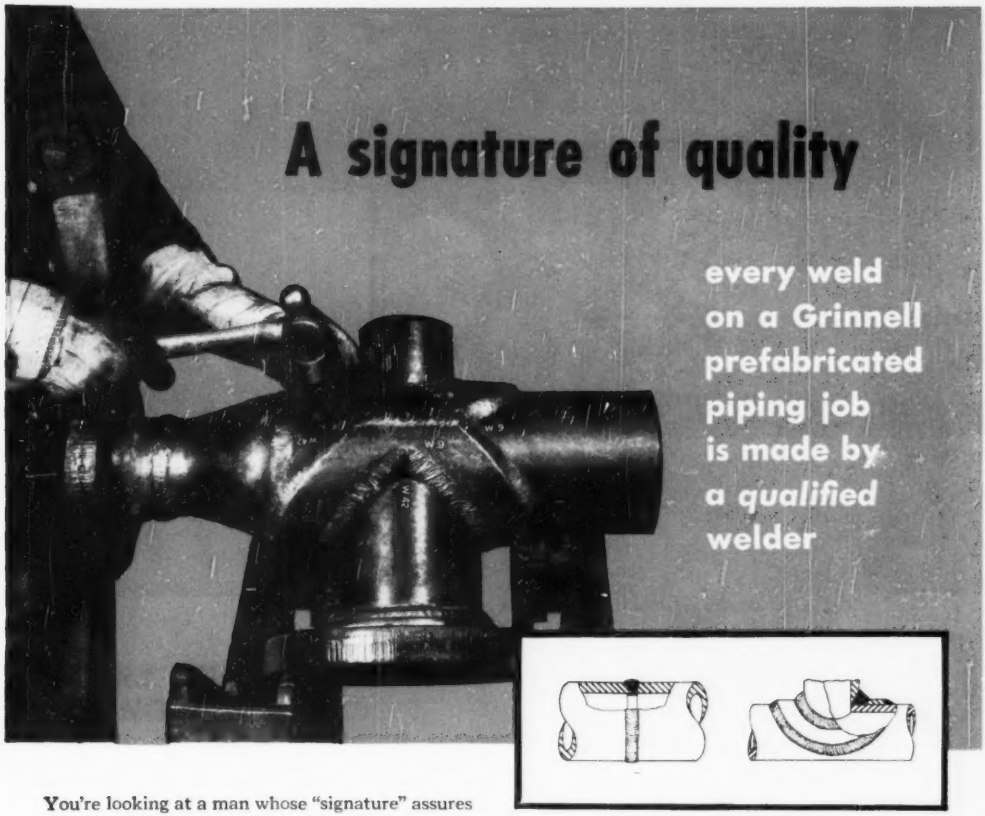
The new type LDS, Long Deadends with the true Stainless bails for disc insulators, and FDS, Flexible Deadends with the true Stainless bails for spool and strain insulators are very light in weight. This reduces vibration fatigue tendencies. They are designed for easy installation and built with ample safety factor, which permits them to do the job both quickly and perfectly.

Reliable **ELECTRIC COMPANY**

3145 CARROLL AVENUE, CHICAGO 12, ILLINOIS

OVER 40 YEARS OF SERVICE TO THE UTILITIES

POWER-LINE CONNECTORS
AND
CONSTRUCTION SPECIALTIES



You're looking at a man whose "signature" assures quality welding of piping. He's a Grinnell welder and, as every Grinnell welder, he is qualified by Grinnell according to a procedure which conforms to A.S.M.E. Boiler Construction Code, Section 9. After qualifying, he is given a number which he "signs" adjacent to each weld he makes.

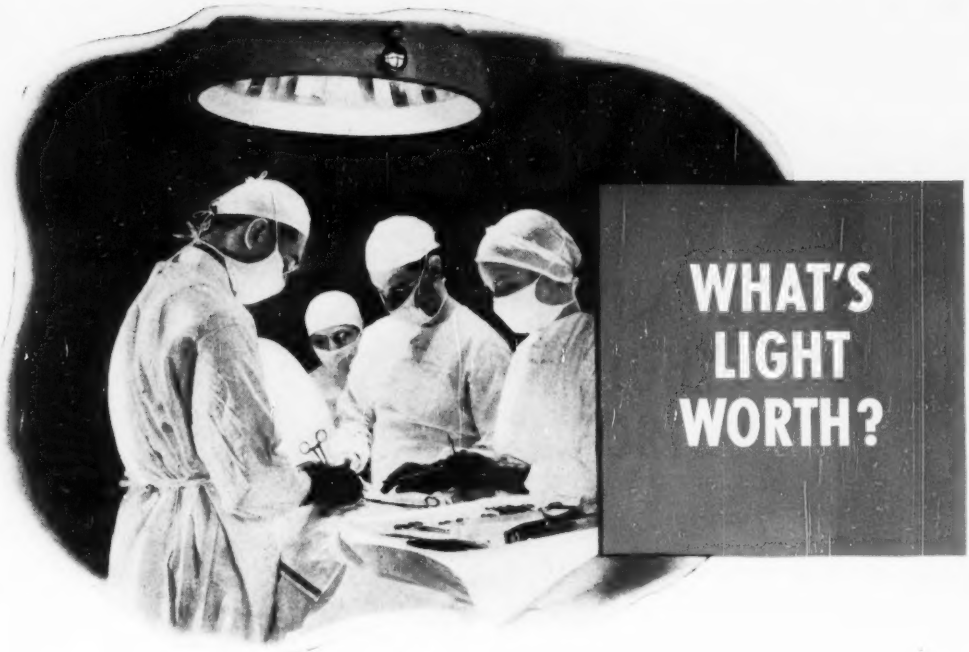
Quality welding is only one of a long chain of responsibilities assumed by Grinnell on every prefabricated piping job . . . from the interpretive engineering to the on-time delivery of the fabricated piping. Such responsibility requires facilities for metallurgical research and testing, comprehensive knowledge of state laws and industry codes, and a complete familiarity with insurance company requirements for fabricated piping.

The fabrication of piping for today's high pressure, high temperature or corrosive services is a job for experts. It's a job for Grinnell prefabricating plants because Grinnell has the modern equipment and methods, and the skilled personnel which enable them to assume total responsibility for the job.

99 YEARS PIPING

GRINNELL

Grinnell Company, Inc., Providence, Rhode Island. Branches: Atlanta • Buffalo • Charlotte • Chicago • Cleveland • Cranston • Fresno • Kansas City • Houston Long Beach • Los Angeles • Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane



LOOK FOR THIS NAME

It identifies aluminum reflectors, made extra bright, that won't chip, spall or peel. Clean them regularly and they will last indefinitely. Leading manufacturers make Alzak reflectors in standard shapes and sizes, in specular and diffuse finish.

Here is where life itself demands the best in lighting. Every foot-candle is needed. It must be controlled and confined. That's why you'll see Alzak reflectors of Alcoa Aluminum in surgery.

Though your requirements may not be as stringent, there's a lesson in economy from surgical lighting. Wire, fixtures and current demand a healthy chunk of cash. Why waste that investment with poor reflectors when Alzak reflectors give you high lighting efficiency. ALUMINUM COMPANY OF AMERICA, 1978M Gulf Building, Pittsburgh 19, Penna.

ALZAK REFLECTORS
OF ALCOA ALUMINUM

ALCOA ALUMINUM

made by Leading Lighting manufacturers

A DRY CHEMICAL EXTINGUISHER WITH TRIGGER-FINGER CONTROL

Here's dry chemical at its fire-fighting best—in *Kidde-designed* extinguishers.

Kidde Dry Chemical Extinguishers use the same simple, familiar principle of Trigger-Finger Control made famous by its performance on *Kidde* Carbon Dioxide (CO_2) Portables.

Pressure of a single finger on the trigger of a *Kidde* Dry Chemical Extinguisher opens the valves—and makes it work. Release the trigger—both valves close.

Small port at bottom of CO_2 outlet tube allows gas to fluff up the dry chemical. *No packing of chemical in chamber.* Powder discharges at top of chamber, through siphon. *No packing at hose connection.* Trigger-Finger Control eliminates shut-off valve at horn. *No packing in hose.* Baffle in horn gives better dispersion pattern. Made in 20 and 30 lb. models.

These are the dry chemical extinguishers you want for most effective action against outdoor fires in flammable liquids and electrical equipment. Mail coupon for literature.

Kidde

Walter Kidde & Company, Inc., 1230 Main Street, Belleville 9, N. J.
In Canada: Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.

Walter Kidde & Company, Inc.
1230 Main Street, Belleville 9, N. J.

Gentlemen: Please send me literature on your dry chemical extinguishers.

Name.....

Company.....

Address.....

City.....State.....

Tops IN THE MILE-HIGH LEAGUE!

The Public Service Company of Colorado handles electricity and gas distribution and transmission for its customers in the mountainous north-central portion of the state. For maintenance work, for readings, for "cutting in" new equipment in inaccessible areas where other means of communication are not available, the company finds G-E radio an indispensable, money-saving tool.

This utility's trouble trucks, line trucks, patrol vehicles and compressors, as well as supervisors' cars are in touch with one another and with headquarters at Denver by radio.

J. M. Wissenbach, Engineering Department, shown above, reports that dispatching by G-E radio *materially cuts elapsed time between receipt of complaint and adjustment of trouble.*

General Electric specializes in radio communication systems for utilities faced with difficult problems of terrain or weather. For complete information call the G-E office nearest you or write: *General Electric Company, Box 1122, Electronics Park, Syracuse, New York.*

Before You Select Any Radio Communication Equipment—

Get This Bulletin FREE!

Colorful booklet about General Electric radio communication will be sent to you on request. Ask for it.

You, too, can put your confidence in—

GENERAL ELECTRIC

"Anaconda" ...always means

Keeping-Ahead-of-the-Parade

TAKE CB* CABLE WITH F-3**
ALLOY SHEATH FOR INSTANCE:

In 1939

Anaconda engineers introduced Type CB cable because ordinary paper-insulated cable wasn't good enough. Carbon-black paper removes oxidation products from the insulation, eliminates ionization discharges. These and other desirable properties increase insulation stability and assure longer cable life.

In 1944

Anaconda engineers added the resilient binder for they had found a way to reduce sheath strain during daily load cycles. Made of special carbon-black paper, it is strong yet resilient, results in lower stresses in the sheath due to cushioning effect, conducts radially and is fully adequate against magnetic forces.

In 1944,

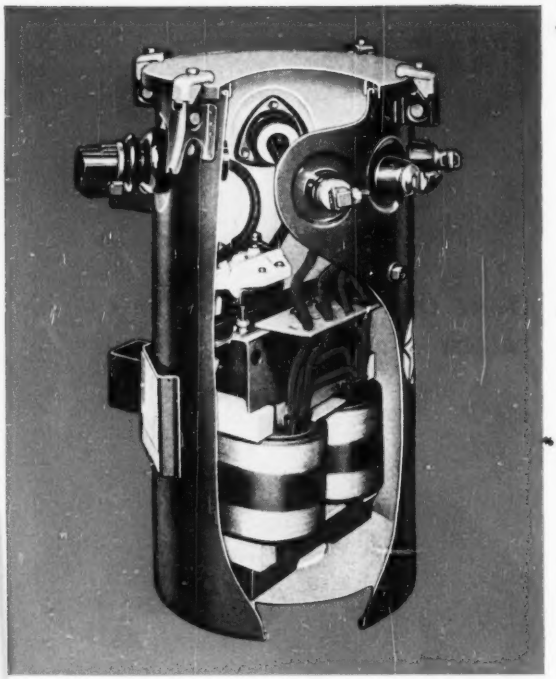
because they know cable life often is shortened by premature sheath failure, Anaconda engineers gave this Type CB cable the amazing F-3 alloy-lead sheath. It is the best all-around alloy ever offered in the industry . . . resists slow-bending fatigue, creep (expansion), bursting, abrasion, vibration fatigue and does not age-harden . . . actually extends sheath life more than three times ordinary sheath. It has truly earned the name "indefatigable."

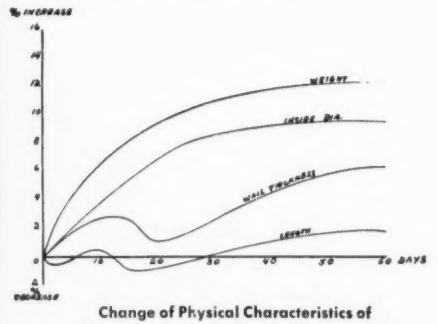
*CB—Carbon-Black, Trade Mark Registered U. S. Patent Office
**F-3—Arsenic-Lead alloy (U. S. Patents 2,300,758 and 2,374,755)

THIS COMBINATION permits heavier loads for longer life!

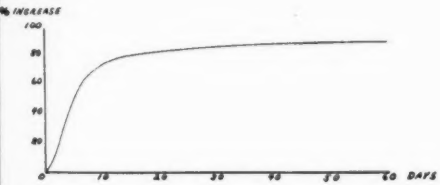
ANACONDA
from mine to consumer

ANACONDA WIRE & CABLE COMPANY
25 Broadway, New York 4, N. Y.





Change of Physical Characteristics of Tubing During 110 deg. C. Oil Aging Test



Flexibility of Tubing During 110 deg. C. Oil Aging Test

What Happens When a Transformer Hits 130 deg. C.?

FOR ONE THING, the vital interior insulating tubing may stiffen, shrink, turn brittle from the combined action of heat and insulating oil.

That is why Dielectric Materials Company ran accelerated heat aging tests on their special formulation based on VINYLITE Plastic. Graphically depicted above, their findings show that the tubing neither shrank, lost weight, nor lost its flexibility!

Today the Pennsylvania Transformer Company takes advantage of its high dielectric strength, economy, and long life in oil-immersed distribution and power transformers—one of which is shown here in cut-away. Overloads may raise its temperature to 130 deg. C. Yet there's every indication that the tubing will match the life expectancy of the transformer itself.

This heavy-duty application of VINYLITE Brand Plastics points up spectacularly the material's usefulness in many other types of wire and cable insulation. VINYLITE Plastics come in many formulations and any color. They are economical, highly resistant to water, oil, most strong alkalies and acids, to sunlight and weather. They're tough with excellent aging qualities. They permit smaller outside diameters, and they slip easily through conduits and around corners.

We'll gladly furnish technical data and discuss your insulation problems with you. Write Dept. HE-28.

Vinylite BRAND PLASTICS

BAKELITE CORPORATION

BAKELITE CORPORATION, *Unit of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

For special conditions:

Anaconda Duplex Tubes

ANACONDA Duplex Heat Exchanger Tubes on request are supplied with the ends of the external tube cut back to receive ferrules for rolling into the tube sheet. Ferrules can also be supplied.

ANACONDA Duplex Tubes are available in a wide range of metals. These tubes can be supplied with the copper or copper alloy drawn either inside or outside of the steel tubing. For example, in a diethanolamine stripper, a copper-steel combination is called for, with copper on the outside of the tubes to resist corrosive steam and steel on the inside to resist attack by the amine.

For general information on ANACONDA Duplex Tubes write for Publication B-2. And remember that ANACONDA metallurgists are always ready to help you solve your tube problems. Address The American Brass Company, Waterbury 88, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

49130

For efficient heat transfer

ANACONDA Heat Exchanger Tubes

Gulfcrest

is the only turbine oil refined by the

Alchlor Process

2 reasons why this is important to you

1 The Alchlor Process is an extra refining step—weeds out more sludgeforming hydrocarbons than any other refining method!

2 The Alchlor Process imparts a greater ability to benefit from special inhibitors that control oxidation and prevent corrosion!

In Cylinder 1 you see the oil that will become Gulfcrest. It has already gone through the usual steps used in refining most other turbine oils — but has not yet been Alchlor-processed.

In Cylinder 2 you see the part—approximately 15%—discarded by the Alchlor Process. This is the part that, when allowed to remain in turbine oil, is most likely to oxidize, increase neutralization number, and form sludge, emulsifiers, and harmful acids.

In Cylinder 3 you see the finished Gulfcrest—the incomparably pure lubricating oil that gives outstanding performance and helps you keep steam turbine systems clean indefinitely. To make it even finer, special inhibitors are added to it—they give it still greater stability and protect against corrosion.

Gulf Oil Corporation
Gulf Refining Company

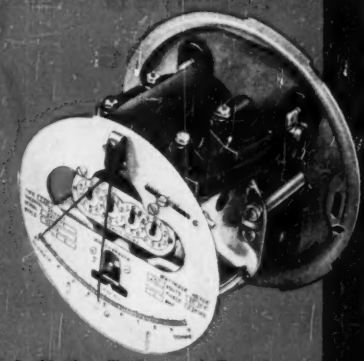
Offices in Principal Cities in 30 States

Call in a Gulf Lubrication Engineer today and ask him to recommend the proper grade of Gulfcrest Oil to meet the specific requirements of your turbines. Write, wire, or phone your nearest Gulf office.

GULF INDUSTRIAL LUBRICATION

Demand metering for small KW loads now economically practical for

SINGLE OR POLYPHASE CIRCUITS



Combination Watthour and Thermal Demand Meter for single-phase circuits.

Combination Watthour and Thermal Demand Meter for polyphase circuits.

Economical demand metering now can be applied to both single *and* polyphase circuits . . . even where the load is small! Westinghouse combines Thermal Demand Meters and Watthour Meters into a *single* unit. Only one mounting is required. Installation is greatly simplified.

These *two-in-one* meters answer your need for Demand Meters with low maintenance characteristics . . . to *economically* meet the continued extension of demand rates to smaller loads. Standardization and simplified design make possible a low first cost. Many parts are the same as standard Watthour Meters. Stocking is simplified.

If your problem is *economical* demand metering for kw *or* kva loads . . . single or polyphase circuits . . . investigate Westinghouse Meters. They provide the information accurately *and* economically. Write for C.S. 42-337 and C.S. 42-338. Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30, Penna.

J-40365

YOU CAN BE SURE.. IF IT'S Westinghouse

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Watthour and Demand Meters for Any Job

TODAY'S CHANGING OPERATING CONDITIONS

GREATER LOADS

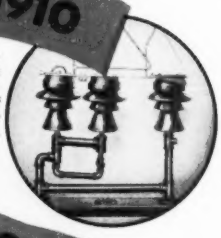
HEAVIER FAULT CURRENTS

INCREASED ATMOSPHERIC CONTAMINATION

• • • A

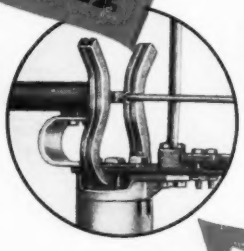
39 YEARS OF SWITCH DEVELOPMENT PRODUCES THE "SWITCH OF TOMORROW"

1910



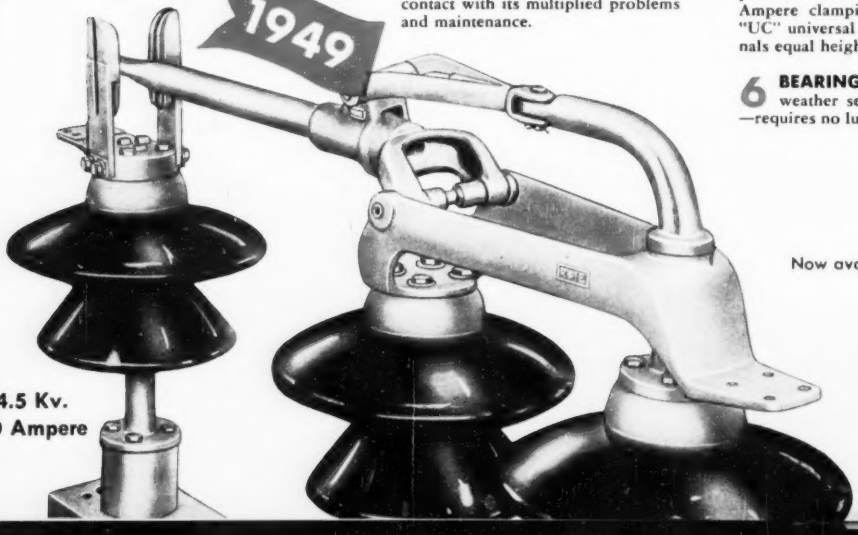
1910—R&IE introduced the "Burke" switch—the forerunner of today's outdoor switching equipment.

1922



1922—R&IE introduced the Hi-Pressure contact, an important improvement in switch design.

1949



34.5 Kv.
600 Ampere

CHECK the FACTS

1 JAW CONTACT—Hi-Pressure, Hi-Thermal capacity silver to copper contact. ONLY ONE BREAK CONTACT on the switch. Copper and beryllium jaw—copper for thermal capacity and beryllium for strength and resilience. Here's maximum protection against fault curren: damage.

2 HINGE CONTACT—Completely enclosed and weather sealed Hi-Pressure, Hi-Thermal capacity, silver to copper Hinge Contact. Continuous, annular, constant electrical and mechanical contact at all times. Eliminates second break contact with its multiplied problems and maintenance.

3 BLADE OPERATING MECHANISM—Simplified and "streamlined" to attain a simple harmonic, accurately controlled blade motion. Special pin fastenings, snap rings, and rivets have been eliminated from moving parts. Universal blade balance on 69 Kv. and above.

4 BLADE—Extra heavy, hard drawn tubular copper with integral, formed contact end. Solid current path from jaw to hinge contact.

5 TERMINALS—Four half-inch bolts on 1¾ x 1¾ inch centers permit NEMA standard 600 or 1200 Ampere clamping and R&IE Type "UC" universal clamps. Both terminals equal height from base.

6 BEARING—Aluminum housed, weather sealed, stainless ball—requires no lubrication.

Now available for delivery

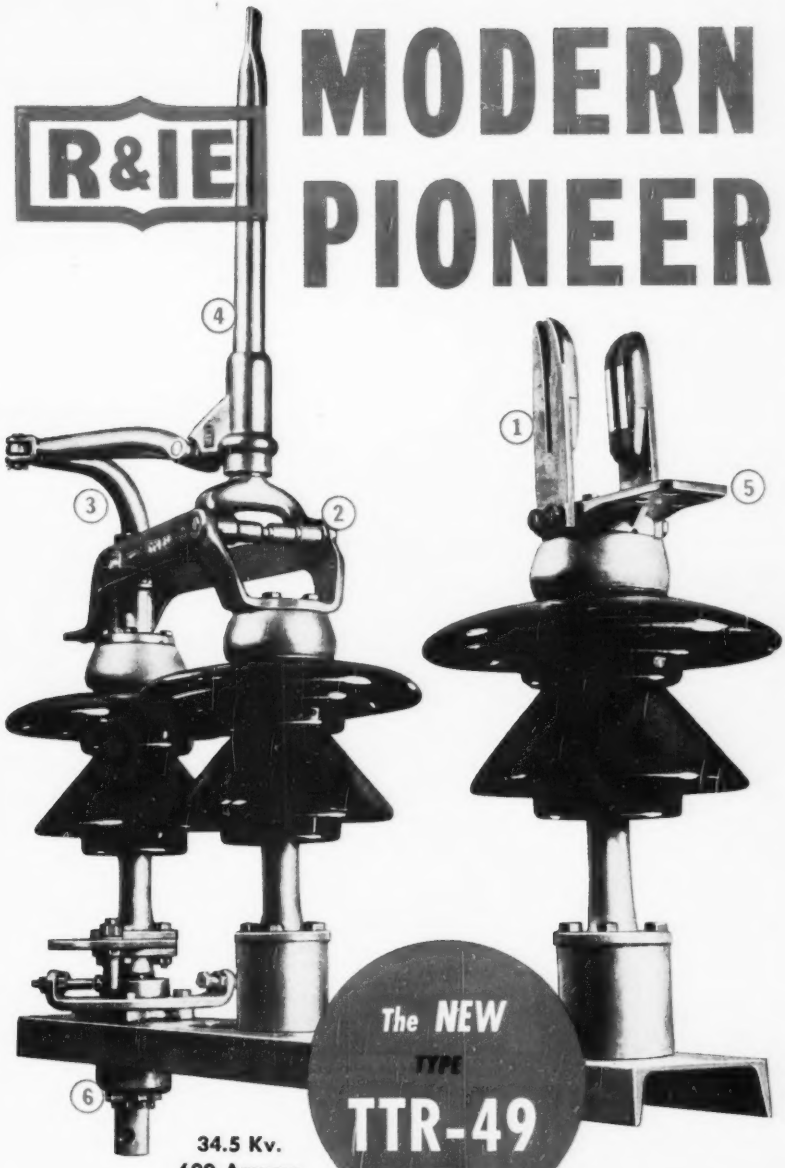
R&IE

NEW Frontier

FOR THE

MODERN PIONEER

R&IE



The NEW TYPE TTR-49

34.5 Kv.
600 Ampere

Before you buy any switch that gives you less

•

CHECK the FACTS on TTR-49

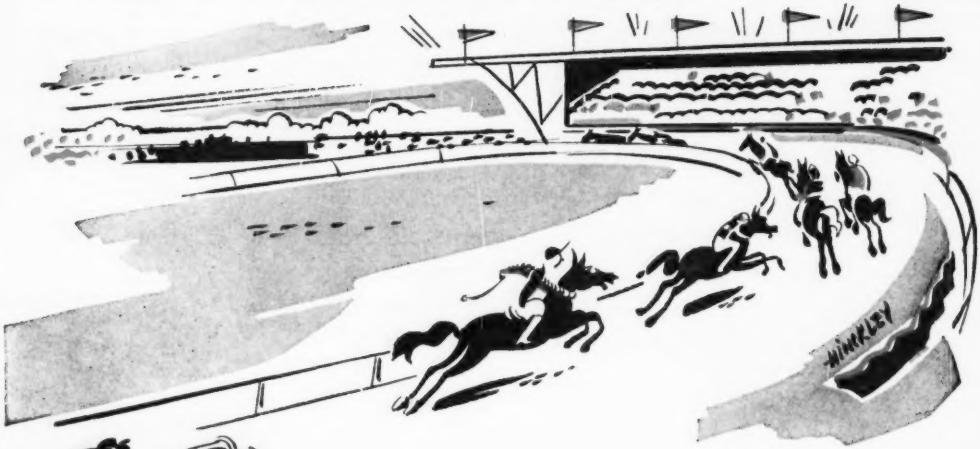
A new conception of switch value

•

RAILWAY and INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

IN CANADA—EASTERN POWER DEVICES LIMITED, TORONTO
An I-T-E ORGANIZATION

YOUR CENTRAL RIGID STEEL CONDUIT DISTRIBUTOR MAKES YOU THE WINNER



CENTRAL
~~SPANG~~
CONDUIT

- You win two ways when you place an order with your Central Rigid Steel Conduit Distributor. You're sure of conduit of unexcelled quality that's easy to bend, cut or thread and that provides maximum safety in any location. And the complete stock of Central Black, Cenlaco and Central White Rigid Steel Conduit carried by your distributor, makes it easy for you to get exactly what you want without delay.

For fast delivery of conduit or other electrical supplies, call your Central Rigid Steel Conduit Distributor . . . and be a double winner.

CENLACO a hot dipped galvanized and lacquered finish, inside and out.

CENTRAL WHITE electro-galvanized outside and black enameled inside.

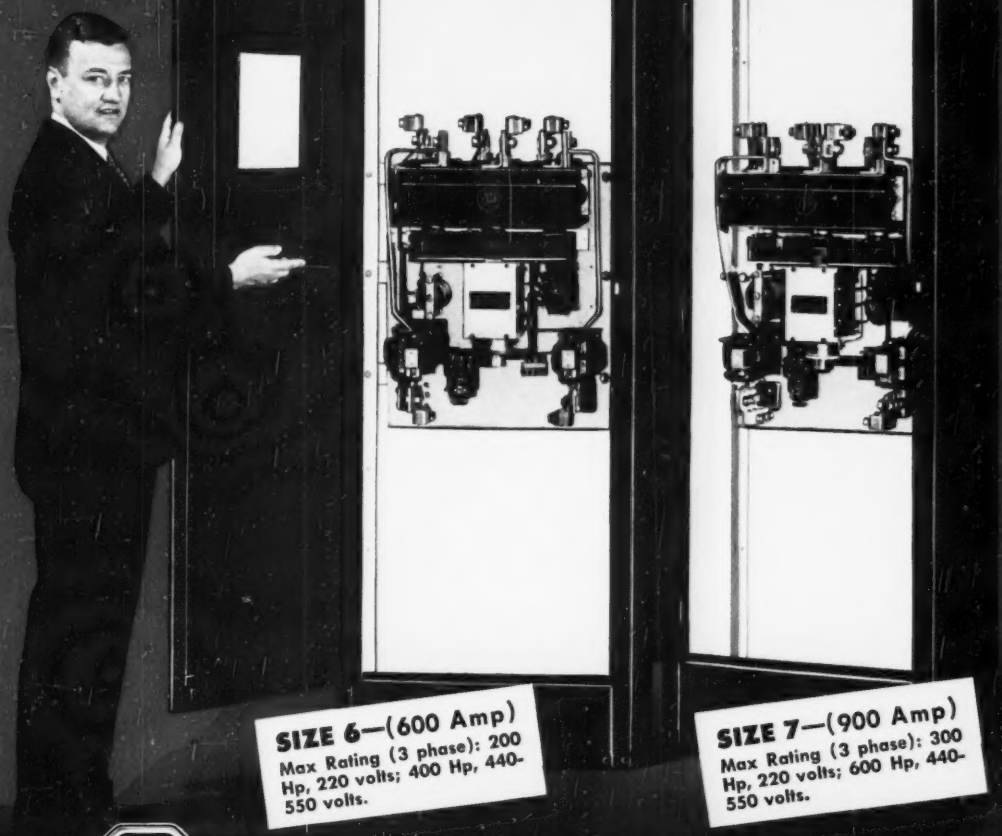
CENTRAL BLACK permanent, baked-on black enamel finish, inside and out.

SPANG-CHALFANT

Division of The National Supply Company
General Sales Office: Grant Bldg., Pittsburgh, Pa.
District Offices and Sales Representatives in Principal Cities

Announcing...

The *NEW* Size 6 and Size 7 SOLENOID Starters



SIZE 6—(600 Amp)
Max Rating (3 phase): 200 Hp, 220 volts; 400 Hp, 440-550 volts.

SIZE 7—(900 Amp)
Max Rating (3 phase): 300 Hp, 220 volts; 600 Hp, 440-550 volts.

A-B Quality

ALLEN-BRADLEY

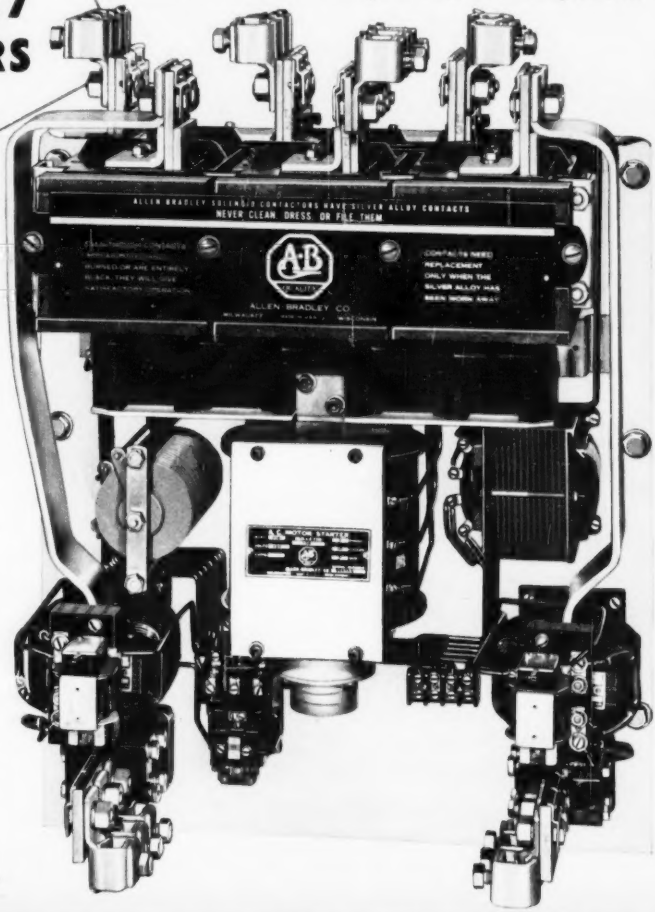
SOLENOID MOTOR CONTROL

SEE OTHER SIDE

Now- All the Advantages of SOLENOID design

in the NEW SIZES 6 & 7 STARTERS

In years of service, under all operating conditions, the Allen-Bradley solenoid construction has proved its superiority beyond all question of doubt. Now Allen-Bradley has developed Sizes 6 and 7 solenoid starters . . . with all the features that have proved so successful in smaller Allen-Bradley starters. Check its many features.



SILVER ALLOY CONTACTS

The double break, silver alloy contacts never require cleaning or filing—a distinct advantage over conventional copper-to-copper contacts.

SIMPLE, RUGGED CONSTRUCTION

These starters have no pins, pivots, hinges, or complicated mechanisms to cause trouble. The solenoid switch mechanism has only one moving part.

SMALLER SIZE

The open type Size 6 starter is less than ¼ as large as conventional starters, and the enclosed unit takes only 58% of the floor space. Size 7 is even smaller, compared with other starters.

STEEL PANEL MOUNTING

The switch is mounted on a metal base plate instead of a slate panel, and is self insulated. It can be quickly and easily mounted to metal surfaces without additional insulation.

FRONT-OF-PANEL WIRING

All terminals and wiring are readily accessible from the front. There is no back panel wiring.

AVAILABLE IN MANY FORMS

Size 6 and Size 7 solenoid switches can be furnished in 2 pole or 3 pole contactors, across the line starters, reversing switches, reduced voltage starters, and many other combinations where clapper type switches were previously used.

Write for Information

Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wis.

A-B Quality

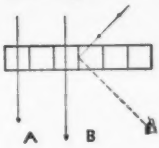
ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

Available now in any quantity—attractively priced

Corning FOTA-LITE glass louvered panels can be used in many types of recessed or pendant lighting fixtures, as well as, for continuous row or completely illuminated ceilings. It is available now in any quantity at attractive prices.



A. Light directed vertically is unrestricted.

B. Diffusing louvers intercept and eliminate eye-level glare.

FOTA-LITE makes possible shallower, dust-tight installations.

The smooth glass surface of FOTA-LITE is easy to clean.

✔ CHECK THESE IMPORTANT ADVANTAGES:

1. Fota-lite assures a 45° light cut off.
2. Fota-lite can be cut to fit almost any standard fixture where louvers or glass panels are desired.
3. Fota-lite has no sag or cold flow—it is glass. No special construction is needed for its support.
4. Fota-lite louvers do not loose efficiency over an extended period of time—they are part of the glass.
5. Fota-lite permits dust-tight fixture construction and thereby easy maintenance because only a single flat surface need be cleaned.
6. Fota-lite causes little contrast in brightness between the light sources on opal vertical surfaces because of large number of louver cells. White louvers are non-color selective.

CORNING GLASS WORKS
CORNING, NEW YORK

SEE FOR YOURSELF—SEND FOR SAMPLE

Fill out and mail coupon below or write for a free sample of Fota-lite

CORNING GLASS WORKS, (Dept. EW12), Corning, N.Y.

Send me Fota-lite demonstration card showing how Fota-lite diffuses and cuts off light at 45°.

Name_____ Title_____

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Again Irvington leads the way . . . with the most complete line of Class "H" insulations obtainable. Now, manufacturers faced with high temperature problems can successfully meet each specific requirement from this broad line. Designers, too, faced with the need to design more compactly, or reduce weights, can select insulations exactly suited to their needs. These Irvington Class "H" insulations are furnished in many thicknesses, and widths up to 36". Complete information, and generous samples, gladly furnished on request.

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VARNISH & INSULATOR CO.
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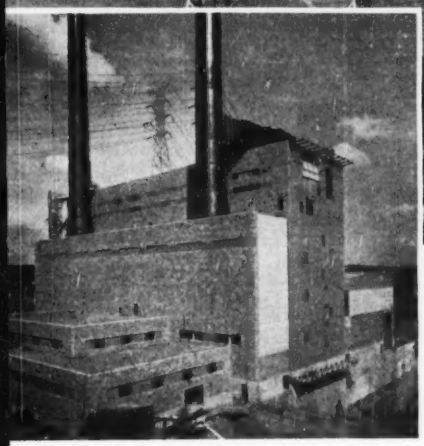
*T. M. Reg. U. S. Pat. Off. by Owens Corning Fiberglas Corp.
**T. M. Reg. U. S. Pat. Off.

A new "high" in tower dependability and economy



American Bridge Company fabricated and erected the structural steelwork for the new Philip Sporn Plant, which utilizes four of the largest steam generators in the country.

These 240-ft. river crossing towers are among the highest in use. They're double circuit, 132 kv towers carrying six 477,000 CM. ACSR conductors and one 159,000 CM. ASCR ground wire.

"Streamlined" towers handle heavy duty job for A. G. E. System

THE tall, double-circuit towers shown above are among the approximately 160 erected to join the new 550,000-kw Philip Sporn Plant at Graham Station, W. Va., to the 132 kv transmission network of the American Gas and Electric System.

Designed and fabricated by American Bridge Company, these steel towers stand as proof of the soundness of "streamlined" towers—stripped of all non-essentials—for even the heaviest duty. Equipped with steel grillage earth anchors, they offer the added economies of simplified installation and frill-free construction that resists wind and wintry weather.

American Bridge has been designing, fabricating and erecting transmission towers for the nation's leading power companies for forty-five years. Its experience and facilities are second to none. Why not submit any questions you might have to our nearest Contracting Office? An inquiry involves no obligation.

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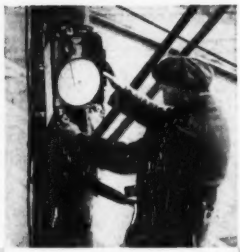
AMERICAN BRIDGE

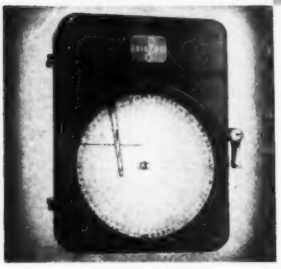
UNITED STATES STEEL

ILLUSTRATION FOR A

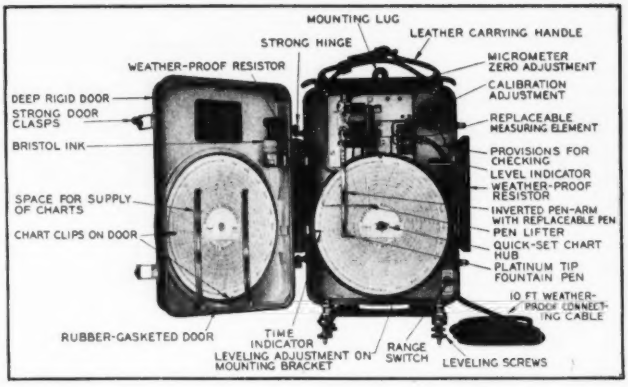
Detective Story

WITH A "PAY-OFF" EVERY DAY





You can put Bristol's All-Purpose Portable Recording Voltmeters and Ammeters *wherever* you need to get a clue as to what's going on in your power distribution system. The instruments are light, compact and weather-tight, suitable for portable service, indoors or out, for pole mounting, wall mounting or in damp cellars and manholes. Models available for permanent mounting on walls, panels and switchboards.



Many thousands of Bristol Electric Recorders—voltmeters and ammeters—are doing "detective work" under every kind of operating condition, helping—with famous Bristol accuracy—to uncover the facts needed for fast, efficient trouble-shooting. Many of the most progressive electric companies use them.

THREE PORTABLE MODELS

SINGLE PEN. Inexpensive instrument for quickly analyzing conditions, investigating complaints, making surveys, general testing, etc.

DOUBLE PEN. Records two different voltages or currents in two separate circuits simultaneously on one chart.

TRIPLE PEN. Records three different voltages or currents in three separate circuits simultaneously on one chart.

Many ranges carried in stock for immediate delivery.

Write for Bulletin E1100, giving full facts on Bristol Ammeters and Voltmeters, THE BRISTOL COMPANY, 116 Bristol Road, Waterbury 91, Conn. (The Bristol Co. of Canada, Ltd., Toronto, Ont.; Bristol's Instrument Co., Ltd., Lynch Lane, Weymouth, Dorset, England.)

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A new line...

BACKED BY A DEPENDABLE NAME

Of course they're electric—these outstanding new Crosley Electric Water Heaters! Now Crosley adds this new line to its growing selection of fine electrical products, offering the public 34 dependable models in a wide choice of sizes and styles.

With Crosley Electric Water Heaters your customers have another powerful incentive for using electricity in the home. With Crosley, homeowners and tenants can depend on plenty of hot water when they need it—quickly, easily, with safety and without soot or odor.

Advanced design and engineering on all Crosley Electric Water Heaters assure you of many dependable features:

- **Simplified Electrical Connections**—located for quick, easy installation
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- **Magnesium Anode Rod**—gives maximum protection against corrosion
- **Immersion Type Heating Elements**—available in single or double arrangement
- **Adequate Capacity**—designed to provide plenty of hot water whenever needed

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ROUND MODEL

Round Water Heaters . . . available in 26 models—12-gallon to 82-gallon capacities.

De Luxe

TABLE-TOP MODEL

Table-Top Water Heaters . . . available in 8 models—30-gallon and 40-gallon capacities.

THE CROSLEY BUILDER'S PLAN

For information on Crosley Electric Water Heaters—capacities, wattage, electrical connections, and other data—write or wire:

Crosley Division
Avco Manufacturing Corporation
1329 Arlington Street
Cincinnati 25, Ohio

CROSLEY *Electric Water Heaters*

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SHELVADOR® REFRIGERATORS . . . FARM AND HOME FREEZERS . . . ELECTRIC RANGES . . . ELECTRIC KITCHENS . . . STEEL CABINETS
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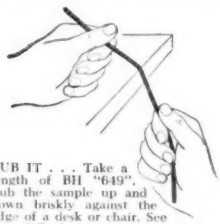
and of course, they're electric! *②

AMAZING BH "649"

. . . cuts insulation costs 2 ways

KNOT IT . . . Take a length of BH "649". Knot it. Pull it as tight as you can. Twist it. Then loosen the knot. There is no cracking. No change in the dielectric strength.



RUB IT . . . Take a length of BH "649". Rub the sample up and down briskly against the edge of a desk or chair. See how difficult it is to damage the coating.

HOLD A MATCH UNDER IT . . . Take a length of BH "649". Hold a lighted match under it. BH "649" will not support combustion.

See how BH "649" cuts insulation costs two ways.

First, it gives you a superior Fiberglas insulation at the price of ordinary cotton-base or rayon-base insulation.

Second, it retains rated dielectric strength even after rough handling, making it possible in many cases to drop one insulation grade and still meet full voltage requirements.

With BH "649" there is little or no loss of dielectric strength in assembly or product use. It stays supple after baking 12 hours at 300°F.

BH "649" is made in Grades A-1, B-1, C-1 and C-2—in all sizes from No. 24 to 5/8" inclusive. Write for production samples.

BENTLEY, HARRIS MANUFACTURING CO., CONSHOHOCKEN, PA.

BH *Fiberglas** SLEEVINGS

*BH Non-Fraying Fiberglas Sleevings are made by an exclusive Bentley, Harris process (U. S. Pat. No. 2393530). "Fiberglas" is Reg. TM of Owens-Corning Fiberglas Corp.

COUPON

Bentley, Harris Mfg. Co., Dept. W-38, Conshohocken, Pa.

I am interested in BH "649" Fiberglas Tubing and Sleeving. Send samples for production testing of Grade_____ in sizes as follows_____ (size or I.D.) for_____ (product) operating at temperatures of_____°F. at_____volts.

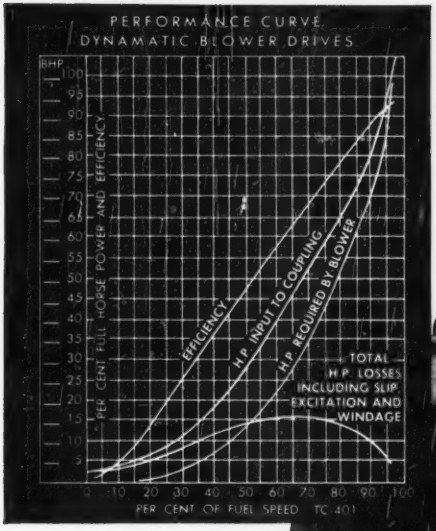
NAME _____

ADDRESS _____

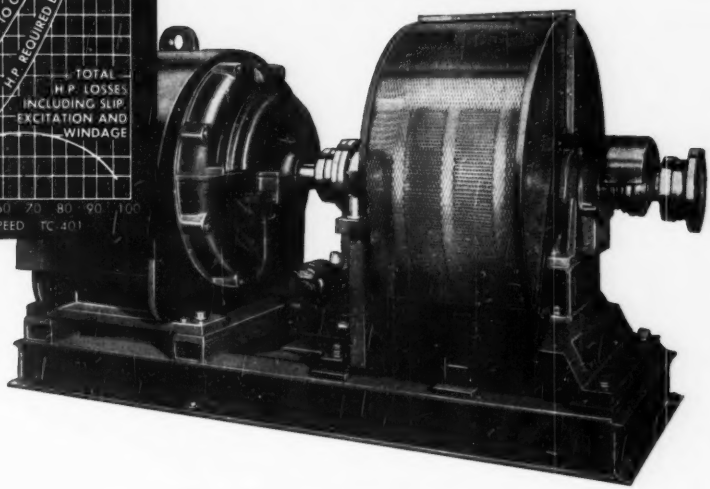
Send samples, pamphlets and prices on other BH Products as follows:

☐ BH non-fraying Fiberglas Sleeving

☐ Cotton or Rayon-base Sleeving and Tubing



EATON DYNAMATIC BLOWER DRIVES



Instantaneous Response to Speed Control

Dynamatic Variable Speed Couplings are ideally adapted to such applications as regulating air drafts in steam generating stations, power house fan drives, public utility induced draft fans, and forced draft fans. Controls can be made to change the output speed of the coupling and hold that speed constant. Response is instantaneous and load changes are closely followed. The speed range available is practically infinite, and can be controlled precisely from ten per cent speed up to full speed.

The performance curve above indicates the characteristics of Dynamatic couplings when driving fans or blowers. Fundamentally, all fans and blowers will have curves very close to the ideal curves shown in this figure. Note the desirable relationship between efficiency, horsepower input, and required horsepower. The horsepower losses indicated are normal for this type of application. Both air cooled and water cooled types of Dynamatic couplings are available, selection depending upon loads and type of service involved. The electric-slip coupling was developed and introduced by Dynamatic; this company has pioneered the use of electric-slip couplings in fan and blower drive applications. Write for illustrated literature.

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NEW BY

SERIES 5200

SERIES 5200 STRAIN CLAMPS

CATALOG NUMBER	MAX. CABLE DIA.	FITTING	ULTIMATE STRENGTH
5200 5210	.55"	Socket Clevis	10,000
5201 5211	.68"	Socket Clevis	15,000
5202 5212	.84"	Socket Clevis	20,000
5203 5213	.96"	Socket Clevis	30,000
5204 5214	1.10"	Socket Clevis	30,000
5205 5215	1.28"	Socket Clevis	35,000

Send For New Catalog

BTC's new catalog of Drop-Forged Hi-Line Hardware will soon be coming off the press. It's chuckful of information you'll want to have on hand—pictures, blueprints and complete specifications on Brewer-Titchener's entire line of Drop Forged Steel, Aluminum and Bronze Hi-Line Hard-Ware. Write today.

THE largest manufacturer of Drop-Forged Steel Transmission Line Conductor Clamps and Fittings, after a thorough investigation of materials, development of production techniques, and installation of new, modern, and efficient manufacturing facilities, now offers a complete new line of Minimum-Power-Loss (M.P.L.) Suspension and Strain Clamps for use on A.C.S.R. and all-aluminum conductors.

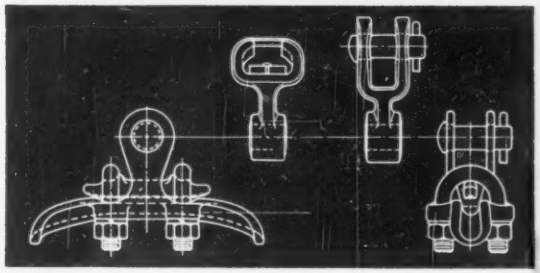
On high-current transmission lines, the use of magnetic ferrous clamps, completely enclosing the conductor, causes considerable hysteresis and eddy current power losses. The conductor heating and annealing effects of such clamps has been the current-limiting factor on some transmission systems.

In the clamps listed here, the magnetic path around the conductor is effectively broken by the use of non-magetic clamp bodies, and power losses, even on heavily loaded lines are negligible—the temperature of the conductor in the clamped section may well be lower than that in the span, due to the greater radiation surface of the clamp assembly.

The general design closely follows that of the time-tested B.T.C. Drop-Forged Steel Clamps, retaining all of their desirable features—Reduction of the effects of conductor vibration by light weight, short connecting length, and smooth die-forged clamp seats with

DROP-FORGED ALUMINUM M-P-L * CLAMPS

BTC



* *Minimum-Power-Loss*

SERIES 9500

ample cable-supporting length and large snubbing radii —Bell-mouthed corona-free large-radius beaded ends.

A wide range of sizes makes possible the selection of exactly the right clamp to fit properly the conductor.

The Suspension and Strain Clamp bodies are Drop-Forged from high strength Aluminum Alloy and are heat-treated, with all of the desirable physical properties of parts produced by these processes—superior strength and resistance to shock and fatigue without excessive mass and weight—uniformity and refinement of internal structure—lasting reliability in service —close dimensional fidelity—excellent finish and appearance.

Clamping Keepers and fully machined Connectors are Drop-Forged Steel.

Connecting Pins, Clamping Bolts, Nuts and Lock Washers are steel.

All ferrous parts are hot-dip galvanized.

Rated ultimate strengths are more than adequate for use on conductor sizes accommodated.

Further information on request.

Sold through your insulator manufacturer only.

SERIES 9500 SUSPENSION CLAMPS

CATALOG NUMBER	MAX. CABLE DIA.	FITTING	ULTIMATE STRENGTH
9503 9533 9543	.83"	Socket Clevis None	18,000
9504 9534 9544	1.00"	Socket Clevis None	22,000
9505 9535 9545	1.15"	Socket Clevis None	22,000
9555 9565 9575	1.27"	Socket Clevis None	25,000
9506 9536 9546	1.375"	Socket Clevis None	25,000
9557 9567 9577	1.45"	Socket Clevis None	25,000
9507 9537 9547	1.60"	Socket Clevis None	25,000
9508 9538 9548	1.80"	Socket Clevis None	25,000
9509 9539 9549	2.00"	Socket Clevis None	25,000
9510 9580 9590	2.25"	Socket Clevis None	25,000

THE BREWER-TITCHENER CORPORATION, CORTLAND, NEW YORK

NEW UTILITY STATIONS C-E EQUIPPED

Includes stations placed in operation since the war (in white) and those under construction or being engineered.

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WHITE RIVER
GADSDEN
POTOMAC RIVER

W. SPRINGFIELD

ORAN
LAKE CATHERINE
WOOD RIVER
DAN RIVER
DUNKIRK
TITUS
HUTCHINSON
BLACK DOG
DALLAS
NINEMILE POINT
EDGE MOOR
YATES
CONTRA COSTA
LEE
HAWTHORN
CLERMONT
JIM HILL
MERAMEC
DANSKAMMER
LONG BEACH

New West goes into

New England's growing electric power facilities received a timely addition of 40,000 kilowatts in November when the new West Springfield Station of the Western Massachusetts Electric Company was placed in service.

This fine, modern plant is conveniently situated to serve the important Springfield district in an area where over 60 per cent of the company's entire system peak load is concentrated within a 15-mile radius. Adequate transmission facilities, however, tie in the new station not only with the Western Massachusetts Electric system but to neighboring systems of the New England network.

Steam for the new 40,000-kw turbine generator is supplied by a C-E Steam Generator, sectional elevation of which with brief description is shown on the opposite page. The entire project was under the direction of the Stone & Webster Engineering Corporation.

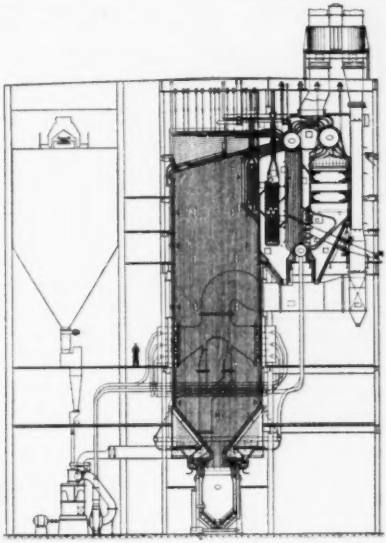
B-347

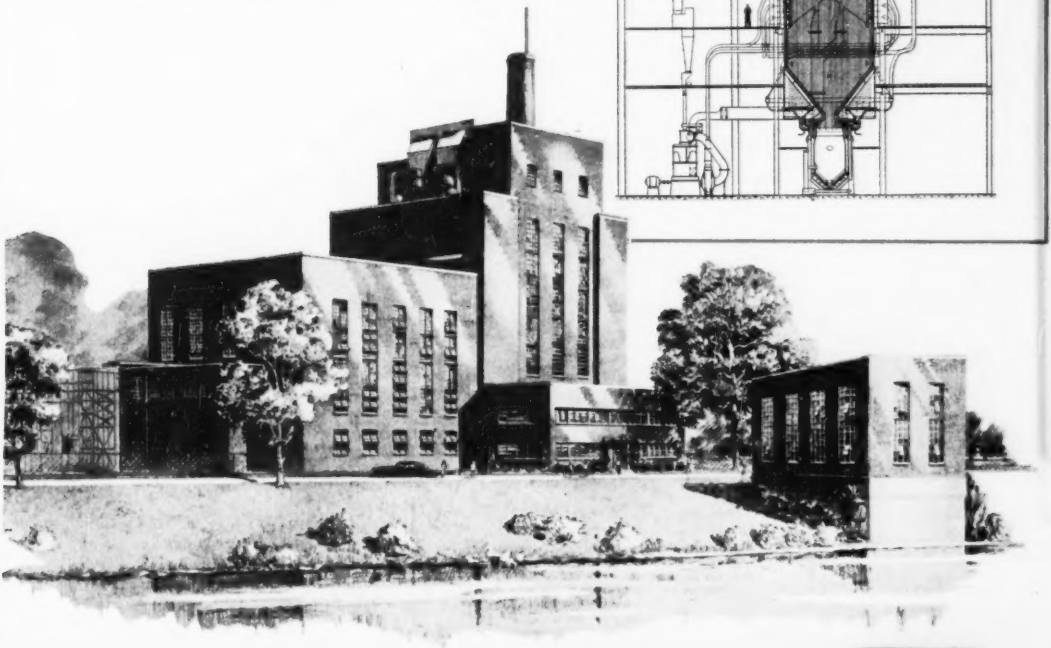
COMBUSTION ENGINEERING

A MERGER OF COMBUSTION ENGINEERING COMPANY, INC. AND THE SUPERHEATER COMPANY

Springfield Station service

The cross-section at the right shows the C-E Unit that was recently placed in service at the West Springfield Station. It is a 3-drum boiler with 2-stage superheater and finned tube economizer surface in the rear pass. Regenerative air heaters follow the economizer surface. The unit is designed for pulverized coal firing, using bowl mills and vertically adjustable, tangential burners. Steam is produced at 875 psi and 905 F.

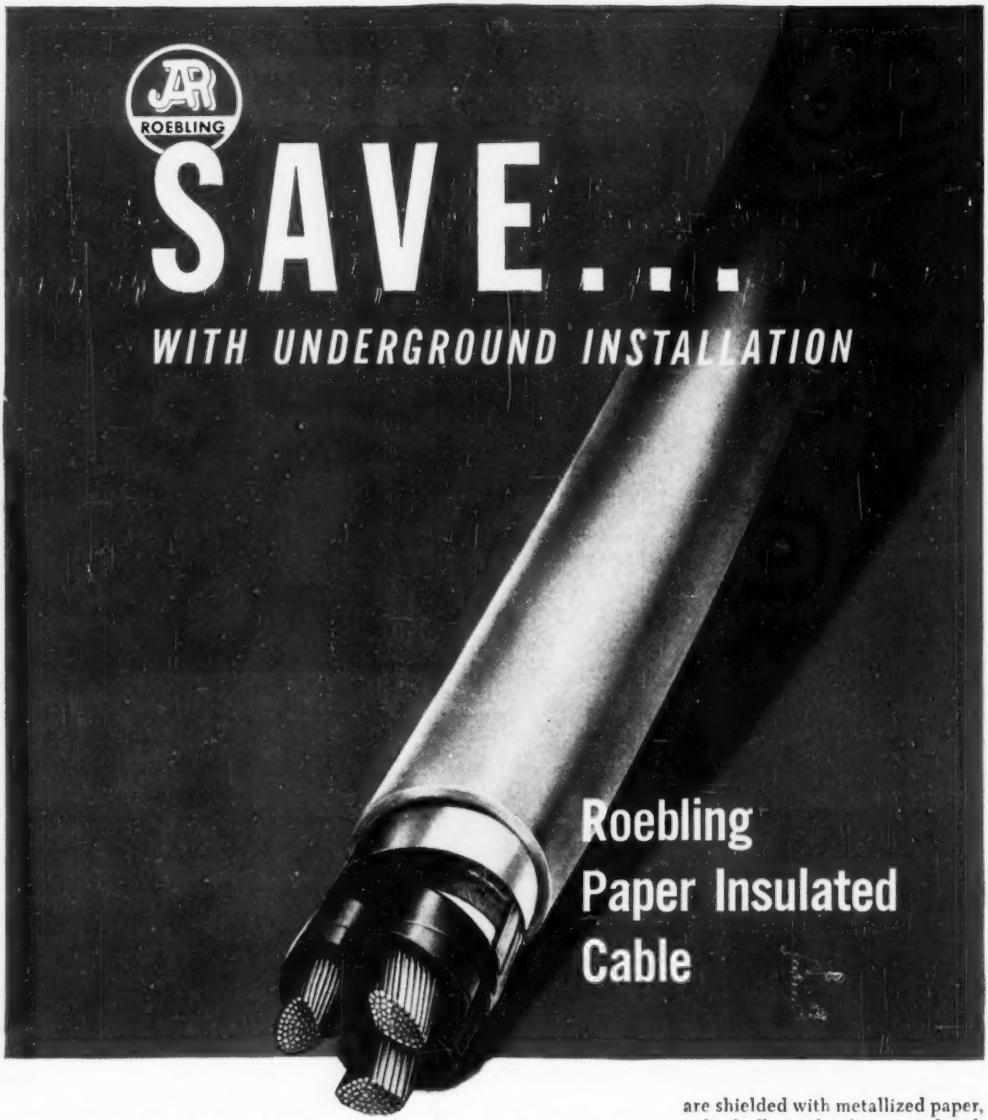




—SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E



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YOU'VE EVERYTHING TO GAIN and nothing to lose (except costly maintenance and eyesores) when you abolish overhead lines. Today's best practice is to put circuits underground . . . and to install Roebling Paper Insulated Lead Encased Cables for long, uninterrupted service at lowest cost.

Roebling Shielded Type H is outstanding for 3-phase grounded neutral circuits from 13 to 33 kv. It comes in both single and multiple conductor construction, in regular and Compack strand (round or sector). Conductors are shielded with metallized paper, individually insulated, protected with perforated copper shielding tape, and then the whole assembly served with a bronze binder tape and lead sheathed.

Your nearest Roebling office and sales engineer will be glad to help you choose the *right* cable for your specific service. John A. Roebling's Sons Company, Trenton 2, New Jersey.

WRITE OR CALL THE ROEBLING FIELD MAN AT YOUR NEAREST ROEBLING OFFICE AND WAREHOUSE

Atlanta, 934 Avon Ave. ★ ***Boston,*** 51 Sleepes St. ★ ***Chicago,*** 5525 W. Roosevelt Rd. ★ ***Cleveland,*** 701 St. Clair Ave., N. E. ★ ***Denver,*** 1635 17th St. ★ ***Houston,*** 6216 Navigation Blvd. ★ ***Los Angeles,*** 216 S. Alameda St. ★ ***New York,*** 19 Rector St. ★ ***Philadelphia,*** 12 S. 12th St. ★ ***Pittsburgh,*** 855 W. North Ave. ★ ***Portland, Ore.,*** 1032 N. W. 14th Ave. ★ ***San Francisco,*** 1740 17th St. ★ ***Seattle,*** 900 First Ave.

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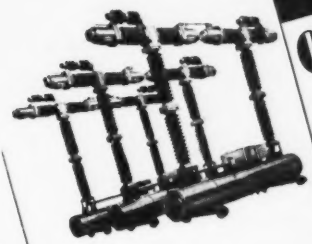
ADVANCED OR CONVENTIONAL?

Advanced, Of Course—and in Breakers, It's the Air Blast Breaker!

ONLY BROWN BOVERI OFFERS A COMPLETE LINE OF AIR BLAST BREAKERS!



BROWN BOVERI OUTDOOR AIR BLAST BREAKER

TYPE DCVF
150 m 4000

Rated kV — 161
Minimum kV for rated Int. Mva — 120
Insulation Level

Low Frequency	Impulse Crest
365 kV	750 kV

Current Rating

Continuous	4 Second
1200 Amps.	25,000 Amps.

Interrupting Rating

4000 Mva	120 to 173 kV

Max. Interrupting Amps: 25,000
Speed: 3 cycles

From 230 kV down to 7.5 kV covering the full range of A.S.A. Standards

These *are* the Features you've always wanted in a power circuit breaker . . .

1—HIGH INTERRUPTING CAPACITY—10,000,000 kVA at 230 kV

2—HIGH CURRENT CARRYING CAPACITY—4,000 Amps. at 7.5 kV

3—HIGH SPEED—3 cycles or less

4—NO OIL — NO MESS — NO FIRE

5—QUICK & EASY TO INSPECT

6—MINIMUM MAINTENANCE

7—RAPID RECLOSING—Both 3-phase or single phase.

8—POSITIVE INTERRUPTION UNDER ALL CONDITIONS including short circuits—normal load—magnetizing or charging currents.

9—SAFETY—No secondary damage even if highly overstressed.

10—DEPENDABILITY—15 years of satisfactory performance throughout the world.

11—LOW INITIAL COST & MAINTENANCE—Costs no more than other types of breakers.

Only a BROWN BOVERI Air Blast Breaker gives you *all* these advantages . . . and *at no extra cost!*

WORLD ENGINEERING & MANUFACTURING LEADERSHIP FOR OVER 50 YEARS IN MECHANICAL & ELECTRICAL POWER EQUIPMENT.

SWITCHGEAR ● REGULATORS ● RELAYS
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WRITE FOR SPECIFICATIONS AND DATA!

BROWN BOVERI CORP., 19 Rector Street, N. Y. 6

Please send me specifications and details on your ☐ indoor ☐ outdoor air blast breakers for ____ kV ____ Amps. ____kVA.

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Company _____

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BROWN BOVERI CORP., 19 Rector St. ● New York 6, N. Y.

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Get

Quality Transformer . . . Superior Switchgear . . . Finest Regulation — teamed for dependable power distribution — that's what you get when you specify Allis-Chalmers Unit Substations.

You get easy handling! Transformers have heavy bases that permit rolling in all directions, convenient jacking pockets and lifting lugs designed for use with all standard lifting devices. Switchgear units provide for lifting bars to assure easy handling without stress or strain on the cubicles. Easy to align throat connections, bolted and no-corona taped switchgear to transformer bus connections mean quicker, easier field assembly.

You get easy operation! The Load Ratio Control panel is at shoulder height, easy to reach, easy to adjust. The no-load tap changer is side mounted, easy to see, and operate.

You get a substation that is accessible for test . . . that requires minimum maintenance. And you get the benefit of undivided responsibility for co-ordination of the completed substation. Less paper work and quicker installation mean added economy. For the full story of what Allis-Chalmers Unit Substations can mean in your distribution system, call your nearby A-C representative or write direct.

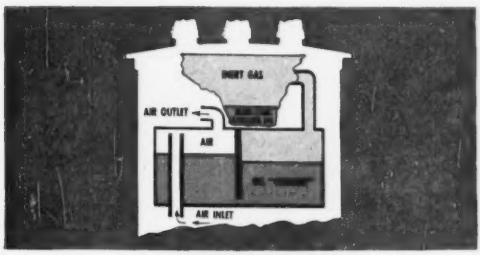
ALLIS-CHALMERS, 932A SO. 70 ST. A-2815
MILWAUKEE. WIS.

PIONEERS IN LOAD RATIO CONTROL— ORIGINATORS OF 5/8% STEP REGULATORS

ALLIS-

What You Want

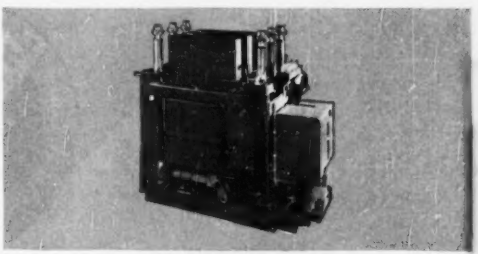
IN ALLIS-CHALMERS UNIT SUBSTATIONS



1. QUALITY TRANSFORMER

Designed for long life with minimum maintenance, these transformers give you the added advantage of the *Oil Sealed* inert gas system of oil preservation. Advantages include the safety of operating pressures usually less than one pound . . . no waste gas . . . no bottles to replenish . . . routine inspection that consists merely of gauge reading.

Radiators are bonderized for protection against rust — have grooved fins for maximum heat transfer and added rigidity. Side Operated Tap Changer is clear of high tension lines, easily accessible and simple to operate. These are indications of the *Extra Quality* features that go into every Allis-Chalmers transformer.



2. SUPERIOR SWITCHGEAR

***Ruptair* is the only vertical lift breaker** with horizontal contact separation which makes full use of the arc's natural tendency to rise, expand, and cool. Extra gadgets to help extinguish the arc are not necessary.

Inspection of the primary contacts is easier and safer because individually spring loaded finger type primary disconnects are located on the removable breaker element. Plug-jumper testing device assures proper contact separation; you can actually *see* the primary disconnects when the breaker is in the test position.

Features: double steel walls between compartments, full length instrument panels, steel barriers between primary and secondary connections, welded steel floors.

3. FINEST REGULATION

Allis-Chalmers pioneered ⅝% step-type Load Ratio Control to give you the finest regulation obtainable. Voltage is easily held to a ±1% band width. You get better feeder or bus voltage under all conditions of load. Momentary fluctuations are averaged by a voltage integrator to prevent unnecessary tap changer operations. The "quick-break" mechanism changes taps quickly and smoothly — shortens arcing time, increases contact life and reduces wear. Lubrication problems are eliminated because the entire mechanism including the driving motor, is completely immersed in oil.

CHALMERS

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SHERARDUCT—

THE *fortified* RIGID STEEL CONDUIT

SHERARDUCT is *fortified* against rust and corrosion by a zinc coating driven into the pores of all surfaces—inside and outside threads. This coating is alloyed with the steel by the Sherardizing Process, and is an integral part of the tube itself.

SHERARDUCT is still further protected by the smooth "Shera-Solution" coating, baked on for added endurance against acids and other corrosive agents.

SHERARDUCT will not smash or split! Reaming does not harm the fortified protection, because the coating is an integral part of the steel itself!

Specify SHERARDUCT—the *fortified*, full weight, threaded, rigid steel conduit. Sold through leading electrical wholesalers.

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Standardization

EVERYBODY WANTS standardization. But most of the proponents accept the idea only if their own pet methods are adopted. That is the reason why little progress has been made to date.

Of course, the progress of joint committees of EEI, AEIC, NEMA, and others is notable. In this issue concludes an article on transformer standardization. A coming issue will discuss standard packaging of line hardware, an accomplishment of the EEI Purchasing and Stores Committee. These are two examples of progress, but there is still a long way to go.

Speaking before the Second Power Distribution Conference of the University of Texas, Ebasco's H. E. McDowell said that failures to standardize are unnecessarily costly to the industry because reasons for differences of opinion have been either minor or nonexistent. Going one step further, he said that "Some of these divergent views could be adjudicated just as satisfactorily by vote as by discussion—cases of tweedle dum, tweedle dee."

As an example, a Southwest pole producer was quoted as saying that no two purchasers agree as to design of pole top roofing. Complete disagreement exists as to number and location of bolt holes.

Pointing out other instances, McDowell referred to practices of using hard and medium-hard-drawn copper; use or omission of weatherproof insulation on primaries and secondaries; suitable minimum sized primary conductor; distribution and transmission voltage levels; transformer taps; similar items carried in inventory; and substation practices.

The subject of standardization is one of the oldest in the industry. It involves not only the utility engineers but also those in manufacturing and consulting. Some blocks in the road grew out of desire for commercial advantage, others from the engineer's wish to apply his own methods. Such reasons are all understandable, but the last vestige of narrow-mindedness must eventually be laid aside for the common good of the whole industry.

The place for leadership is in the utilities themselves. They will be the recipients of most of the economies to be gained. The gains from standardization will show up in their lower capital and maintenance costs. Such gains will not be for today only. They will live through posterity as a monument to those who willingly gave up their own preferences for the good of the industry.

Renewed efforts to press forward toward standardization might well be the best New Year's resolution of them all.

Clint Spurr Gets a Medal

"WE ARE in community development work because we think it is good, sound business to be in it. . . . Ours is not a program designed as public relations or philanthropy; rather it is the realtistic view that by helping to make our communities grow, we will likewise grow."

This is the complete statement of why every power company should participate actively, should take the lead, or should go it alone if necessary, in forwarding the interest of the area it serves. These are the words of A. C. Spurr, president, Monongahela Power Co. recipient of the 1949 Gantt medal. The award is made jointly by the American Society of Mechanical Engineers and the American Management Association "for distinguished achievement in industrial management as a service to the community."

Characteristically, Clint Spurr deprecated his own part in the work that built a profitable market for previously unsalable coal, brought new factories to the Monongahela Valley, increased industrial employment, and raised the standard of living on practically every farm in the area. He preferred to pass on the credit to his co-workers in business and civic activities in the included communities, in state and local farm organizations and agencies, and in his company.

This is laudable modesty, part of the man himself. Without it he could not have accomplished what he did. But it does not deceive us who know him. We know that he is the mainspring, the prime mover, in what has been and is being done to make the Monongahela Valley a better place in which to live and work and play. And we think the people of the Valley will nod in approval as ELECTRICAL WORLD tips its editorial hat to Clint Spurr.

House Heating but No Data

AN ELECTRIC utility head man who continues for too long to ignore house heating developments on the premise that it is a matter for the other fellow to think about, may be in for a rude awakening.

As of now, electric house heating is in that stage of development when data on its load characteristics should be in process of accumulation and analysis in anticipation of its future growth. There should now be appearing in technical literature a continuous succession of articles telling what this, that, and the other utility has learned about this new load and the problems and technology of serving it. But, except from areas where the heating load has grown to significant—and frequently troublesome—proportions, such articles are not forthcoming. The fact that the load has been troublesome in certain cases should be a strong reason for the utility that has opportunity for it to investigate this new load in the local circumstances of climate, rates, and system facilities. Many utilities have such opportunities, but apparently few are taking advantage of them.

Take radiant heating. In a paper to the Southeastern Electric Exchange this fall, Frederick Combier, U. S. Rubber, said that over 100 installations of his company's product were in operation last winter and that there will be over 500 in 40 states this winter. Yet judging from the availability of performance data on such installations there is a jarring lack of utility interest in the behavior of this new load.

Radiant electric heating is a field that beckons the enterpriser, perhaps because of its novelty appeal. Whatever the reason, the number of makers of, or of what they can call, such equipment can be expected to increase. There are four or five already. One hears variously that this or the other of the large electrical manufacturers is well along on product development in this field. It is obvious that radiant will be increasingly sold, as will other forms of electric heating.

Neither climate nor cost will keep electric heating from people who want it and can pay for it. A lot of folks buy Cadillacs in preference to lower-priced cars. And the Cadillac bracket is a big market for electric house heating even where winter comes early and stays late.

NAM's "Fight for Freedom"

THE VOLUME of material extolling free enterprise is reaching landslide proportions at the publishing end but is still only a dribble at the receiving end. The few receivers too often are those who agree with the material rather than those who need to be convinced by it.

Perhaps this is repetition, but utilities are still one of the best agencies for influencing public opinion. It is for this reason that we feel obliged to call to our readers' attention important contributions to the literature on free enterprise. Today this literature frequently includes the comic book—a powerful medium of influence not only among children but also among their elders.

Latest contribution in the fight to preserve free enterprise, and one worthy of mass distribution, is *Fight for Freedom*, a comic book published by the National Association of Manufacturers. Its authors have dipped into the great episodes of American history and compared the freedom here to the lack of it under Mussolini, Hitler, and Stalin. Finally they have reviewed what Americans can do to protect their liberties. This book should be an excellent sequel to NAM's *We Hit the Jackpot*.

On a much higher plane but too "dry" for mass reading is a second NAM booklet, *Sum and Substance*. It is a digest of speeches and articles. Although this booklet provides excellent speech material, it probably would not appeal to more than 1% of the reading public.

Each of these booklets should be reviewed and put to the use for which it is best fitted—the comic book for mass circulation, the speech booklet for circulation to the intellectual leaders in all fields who themselves are influential in forming public opinion.

The Electrical Week

Good news for the nation. The privately owned and municipal utilities will spend over $2 billion this year for new plant and equipment. Next year they will spend about as much. In addition the federal power agencies and the co-ops will spend about another half billion each year. All in all, the industry's spending will be a big contribution to better business . . . Interior wants a rehearing on the FPC's Kings River decision which favored power development of the river by Pacific Gas & Electric Co and a municipal agency . . . REA has advised its co-op borrowers to stay out of the phone business, but members of the electric co-ops may form phone co-ops . . . A new super-co-op has received REA loans which will permit it to acquire the Southern Utah Power Co . . . And in Missouri another new super is trying for a loan. If it gets the loan, SPA has agreed to buy all power the co-op produces and to lease its transmission lines . . . And as usual in December output is rising to new highs—last week it was a history-making 5,881 million kwhr plus.

The battle is on in Virginia where the Old Dominion Electric Cooperative has asked the State Corporation Commission to allow it to borrow over $14 million from the REA. If Old Dominion gets the money it will build a steam plant and transmission lines into territory now served by the Virginia Electric & Power Co.

A new Office of Administrative Management has been established in the Department of the Interior to streamline the Department's budget and personnel operations. New title, executive officer of the Department, goes to Vernon D. Northrop, previously director of Interior's Division of Budget and Administrative Management and a veteran of more than a quarter of a century of government service.

The present water shortage in the East, especially that in the metropolitan New York area, may make that area sympathetic to the problems of areas elsewhere where water shortages are common.

In denying a charge by a Texas co-op manager that Texas Power & Light Co is "definitely not living up to terms" of its agreement with SPA, a spokesman for the latter said, "Our people say the company is more than living up to its contract."

The 300-ft smokestack being erected at the Perry-W Plant of the Indianapolis Power & Light Co will replace two 185-ft stacks, will cost almost $74,000, and will be composed of some 400,000 radial bricks.

There may be some job announcements within the next two weeks, but it now appears that Jan 1 will find three leading federal power planners among the unemployed. They are David E. Lilienthal, who retires as AEC chairman Dec 31; Julius A. Krug, former Secretary of the Interior; and Leland Olds, who has been jobless since last June.

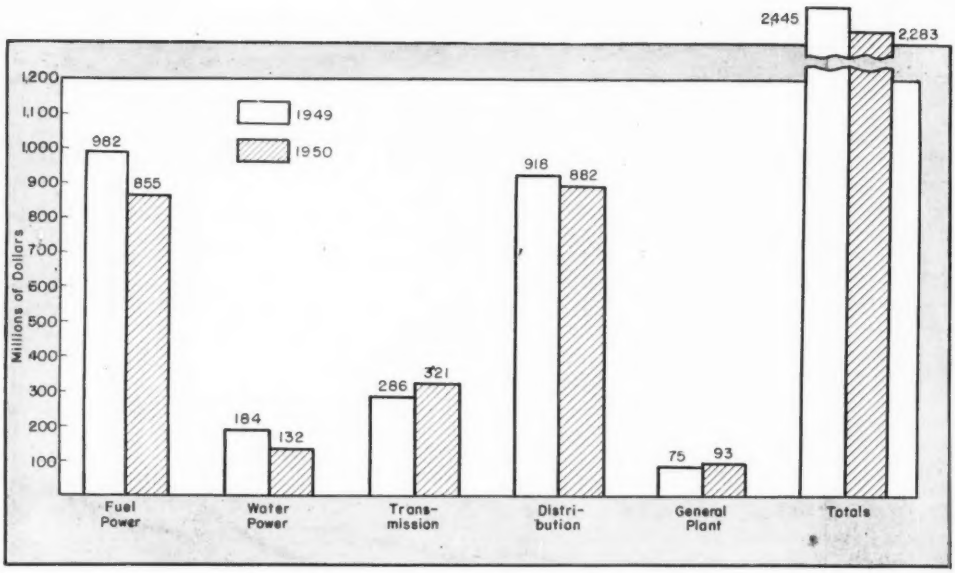
Power issues will be the center of another hot political fight next year in Oklahoma. Up for reelection is Southwest Power Administration critic Sen Elmer Thomas. Representative A. S. Monroney, proponent of federal power program, will announce his candidacy for Thomas' seat in January.

The October fuel picture—Oil consumption of 6,655,555 bbl was 103.7% greater than in October 1948. This was a new record. Natural gas use was up 21.6 above a year ago. Coal use was down 27.5% to 6,569,357 tons. Coal stocks on hand were sufficient to last 113 days.

Engineers at the U. S. Department of Agriculture are cautioning farmers against over-enthusiasm in using lights and electrical traps against several insect pests. More research is needed to establish most practical methods, say the engineers. Invisible "black light" radiations were found best for attracting moths in experiments in Indiana.

Notes From The News

Companies of the Commonwealth Edison Co have received permission of the Illinois Commerce Commission to do postcard billing . . . Bonneville Power Administration will open an office at Kalispell, Mont. John L. Mangan will be in charge . . . In Washington the operator of a trench digger, unaware that he had severed the power lines to the Air Force's Bolling Field, kept working until he had cut also the lines from an emergency generator to the base's control tower. Two small planes were sent aloft to serve as control towers and safely landed 56 planes while the lines were repaired . . . Ontario Hydro-Electric Power Commission has eased the restrictions on store lighting for the Christmas season. However, the new rule applies only after 7 PM.



Utilities to Spend $2 Billion in '49 '50

ELECTRICAL WORLD Survey, Preliminary to Statistical Issue, Reveals That Transmission and Distribution Outlays Are Rising, Generation Decreasing

ELECTRIC UTILITY industry spending for new plant and equipment, about to hit a new high of $2,445 million for 1949, will approach the same record figure next year.

These estimates are based upon preliminary data compiled by ELECTRICAL WORLD for its annual survey of new construction and capital expenditures. Data drawn from reports to EW by companies and municipal utilities representing 60% of the industry indicate a total outlay of $2,283 million during 1950, just 6% less than the estimate for this year.

But subsequent reports, as yet uncompiled, indicate even heavier spending next year by the remaining 40% of the industry. Inclusion of these figures probably will raise capital expenditures of the industry—exclusive of the federal plants and government-financed electric cooperative systems—to more than $2.3 billion for 1950.

The completed survey, covering capital budgets of federal and co-op power operations as well as company and municipal system spending, will appear in ELECTRICAL WORLD's annual statistical issue Jan 30.

Federal and federally financed co-op spending, which was not reported, has been conservatively estimated at $500 million for each of the two years covered. This would bring total outlay for power plant to at least $2.9 billion in 1949 and to more than $2.8 billion next year.

Based on the preliminary estimates from 60% of the industry, the accompanying chart indicates a tapering off of expenditures for addition of generating facilities. But, though this spending is indicated as dropping from $1,166 million in 1949 to $987 million next year, there is little or no decrease anticipated in the rate of actual installations. Plans for plant additions reported to ELECTRICAL WORLD call for installation of new generating capacity totaling approximately 5 million kw per year through 1952. For 1953, capacity additions are indicated as dropping to 2.5 million kw.

Decline in estimated expenditures for generation without a corresponding cutback in plans for capacity additions probably reflects several factors. Probably the most important of these is that most utilities already have built or started new generating stations, the initial cost of which included buildings as well as generating equipment. Thus installation of additional equipment in such stations would show up as smaller costs on future budgets.

Despite the anticipated 15% decline in expenditures for generation, an increase of 12% for transmission, from $286 million in 1949 to $321 million in 1950, is indicated. Expenditures for distribution also are predicted to stand up well, declining only 4%, from $918 million in 1949 to $882 million next year.

These items point up an established phenomenon in the history of electric utility construction. A surge in additions of generating capacity traditionally is followed by a period of high investment in transmission and distribution.

This trend is even more clear in the ratios of generating and distribution expenditures in the 1949 and 1950 totals. This year, generating plant accounts for 47.5% of total capital expenditures, with distribution representing 37.5%. As generation drops to 43.2% in 1950, distribution rises to 3[illegible].6%.

Continuation of this shift from generation to distribution spending, with little difference in total capital expenditures, is anticipated for several years while other phases of the industry are catching up with the enormous expansion of capacity.

The survey bears out the predictions made for 1950 in a mid-year check of utility budgets reported in the Aug 27 issue of ELECTRICAL WORLD. At that time it was estimated that power companies and municipal systems would spend a total of about $2.3 billion in 1949, a conservative figure as it now develops. But a prediction of total expenditures of $2.2 billion for 1950 looks even more precise, though still on the conservative side.

•

2 Indiana Companies Plan Territory Swap

Two Indiana electric companies are awaiting approval of the Public Service Commission to swap portions of their service areas. The companies are Public Service Co of Indiana and Indiana & Michigan Electric Co. The former will transfer 3,700 customers, the latter 2,500. Indiana & Michigan will pay Public Service $529,000.

Public Service will take over the towns of Delphi, Camden, Lagro, and Fountain City and will give up Union City, Yorktown, Daleville, Chesterfield, Swayzee, and Cowan.

The proposal, aimed at more adequate and efficient electric service in the areas affected, resulted from a joint survey by engineers of the two firms.

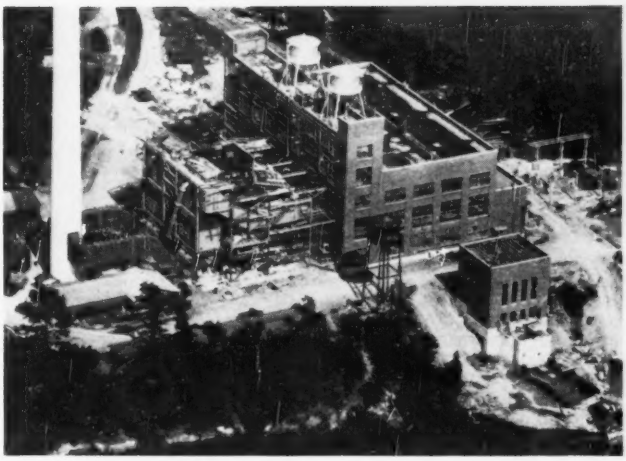
Behind the swap is this: In their growth, both companies have bought utilities, some of which had towns somewhat out on a limb as far as being close to a source of power. The swap will consolidate the service areas.

•

Utilities, Manufacturers Get NAM Representation

Both electric utilities and electrical manufacturing companies are well represented as the result of the recent election of National Association of Manufacturers.

Elected directors were Earl R. Mellen, president, Weston Electrical Instrument Corp; H. E. Humphreys, Jr, president, United States Rubber Co; Louis V. Sutton, president, Carolina Power & Light Co; George L. Draffan, president, Ohio Brass Co; W. W. Lynch, president, Texas Power & Light Co; Kinsey M. Robinson, president, Washington Water Power Co.



WORK NEARS COMPLETION on 88,000-kw Lake Catherine power station being built by Ebasco Services, Inc, for Arkansas Power & Light Co. Operation is scheduled for Jan 1. Plant is located near Jones Mills aluminum reduction plant of Reynolds Metals Co, which has contracted for most of the new plant's output for transforming alumina into aluminum

Interior Asks Rehearing on FPC's Kings River Order Favoring Utility

SET BACK by a Federal Power Commission decision which may have far-reaching implications, the Department of the Interior has asked for a rehearing on orders authorizing power development of the Kings River, Calif. by the Pacific Gas & Electric Co and the Fresno Irrigation District (EW, Nov 19, p 90).

In twin actions Dec 9, attorneys for Secretary Oscar L. Chapman filed a motion for his intervention in the proceedings and an application for rehearing on the Kings River orders. The FPC, in its first five-man decision in many months, unanimously ruled Nov 10 that licenses for the installation of 274,000 KW on the river should be granted to PG&E. The Fresno District was granted a preliminary permit for investigation of power development at the Pine Flat Dam, now under construction on the Kings River.

The decision, first one participated in by Commissioner Mon C. Wallgren, reversed the findings of an FPC examiner who had held, as Interior has argued, that public interests would "best be served" by Federal development of the river. In reversing this recommendation, the Commission said that PG&E was ready to start immediate work on the project, while Interior's Bureau of Reclamation had only begun to plan for power developments which promised fewer kilowatts.

Since the licenses were granted, the company has announced plans for an early start on the Kings River projects (EW, Nov 26, p 11).

The petition for intervention by Secretary Chapman and the motion to permit filing of the petition cite previous participation by the Department through the Bureau of Reclamation and contend that the Kings River is a part of California's Central Valley Project. The latter argument is developed in the application for rehearing, which states that President Truman in a letter dated Aug 15 had specifically concluded that Pine Flat power should be developed by the Bureau.

In its decision, FPC held that while the river is in the general area of the Central Valley, its power development comes under the Federal Power Act.

Interior's fight against the Kings River decision is not motivated alone by concern for the California river's future. Interior officials also are alarmed over similarities between the present issues and those in the forthcoming Roanoke Rapids case. Both

involve proposals for private development of power sites marked for Federal development, and the Kings River decision may indicate rough sailing for federal power planners when this issue arises in the future.

•

Avoid Phone Business, REA Advises Its Co-ops

Rural Electrification Administration has told its electric cooperatives to stay out of the new federal farm telephone program. But REA is not averse to having electric co-op members form new phone co-ops. This advice came in a letter to all REA borrowers from REA Administrator Claude R. Wickard last week. Wickard asked for cooperation in spreading word of REA's new telephone program but asserted REA's view that power co-ops should not go into the phone business.

The statement was the first indication of the lending agency's policies in its new job. President Truman signed legislation authorizing loans for rural telephones Oct 28, and REA received an appropriation of $250,000 for administrative expenses and $25 million in loan funds for the 1949-50 fiscal year.

Electric cooperatives, Wickard declared, should "confine their operations to the power service field rather than enter the telephone business." Arguments cited for this policy included:

1. Federal bookkeeping, which requires complete separation of loans for electrification and loans for telephones.

2. Differing needs of co-op members. Membership of an electric co-op "will rarely be identical with that of a telephone co-op." Even if they were identical, "operation of two services by separate organizations would be desirable."

3. "Substantial legal obstacles to electric cooperatives entering the telephone business" in many states. These are now under study, the letter added.

4. Preference provisions of the phone loan law for applicants now operating phone systems.

Where telephone co-ops are formed, Wickard suggested that "the same persons who are presently members of rural electric cooperatives might well form the nucleus of this new and separate co-operative."

The letter said that REA is not yet ready to act on telephone loan applications. It asked electric co-ops to keep their members informed on the phone program and to supply REA with names and addresses of mutual and co-op telephone associations in their areas and their officials.

Super-Co-op to Purchase Southern Utah Power Co; REA Grants Loan

A NEW SUPER-CO-OP will use Rural Electrification Administration funds to acquire generation and transmission systems of the Southern Utah Power Co. while most of Supco's distribution lines will be purchased by four REA-financed distribution co-ops in the area, REA announced this week. Five loans totaling $9,417,000 have been approved by the lending agency for the southwest Utah program.

The new "G and T" co-op, Southwest Utah Power Federation of Cedar City, will receive $7,885,000. Some $6.5 million of this amount will be spent for new generation and transmission facilities, while the remainder will be used to purchase Supco facilities.

Member Co-ops Get Loans

Four of the five member co-ops of the new Southwest Utah cooperative have been approved for a total of $1,532,000. This will be used to acquire 224 miles of Supco lines serving 2,219 consumers plus construction of 246 miles of additional line to reach 759 new consumers. Included are all distribution facilities of Supco outside of Cedar City. The fifth member of the new super co-op will be consolidated with one of the other four distribution systems.

The entire plan for REA expansion in southwest Utah will be delayed until Cedar City, now served by Supco, has adopted some plan for municipal ownership and operation of distribution facilities within the city. Election to approve or reject a bond issue for purchase of the Supco system within Cedar City is scheduled for Dec 30, REA said. If the issue is approved, the city will buy power wholesale from the Federation.

Co-op Will Serve Municipality

Another city in the area, St. George, has a municipal system which will be served by the co-op.

Supco facilities to be acquired by the Federation under the new plan include a steam and diesel generating plant at Cedar City, a diesel plant at Kanab, four small hydro plants, 208 miles of 33-kv transmission lines, 30 miles of 44-kv line, and substations with a total capacity of about 12,000 kva. Some generation and transmission facilities of member co-ops will also be acquired. New construction will include an 18,000-kw steam generating plant at Cedar City, 140 miles of 69-kv line and 20 miles of 44-kv line. The new generating plant will give the Federation a total installed capacity of 27,754 kw.

In announcing plans for taking over the Supco's system, REA charged that "increasing inadequacy of Supco's power supply facilities has resulted in extensive damage to users' facilities and substantial losses to the co-operatives." REA estimated present total usable power capacity of the co-ops and Supco at 9,754 kw, with requirements soon expected to reach 22,967 kw.

Another major "G and T" loan in the West is expected to get REA approval within a few weeks. This will allot some $8.5 million to a North Dakota co-op combine for construction of a 45,000-kw steam generating plant in the Minot area.

The new steam plant in North Dakota will be connected with Garrison Dam, scheduled to be completed in 1954, through lines built by the Bureau of Reclamation. Reclamation received funds for the lines tying in with the proposed steam plant during the last session of Congress.

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Private Utilities to Get Less BPA Firm Power

New one-year Bonneville contracts for firm power for private utilities in the Northwest promise 311,000 kw of firm power, down 59,000 kw from last year. The companies have been warned that it is probable that the following year no firm power will be available for them.

Sharing the available power under the new contracts are Portland General Electric Co, 130,000 kw; Pacific Power & Light Co and Washington Water Power Co, 120,000 kw jointly; Puget Sound Power & Light Co, 50,000 kw; and Mountain States Power Co, 11,000 kw. The contracts permit reduction in power deliveries in February, March, and April in case of low water flows.

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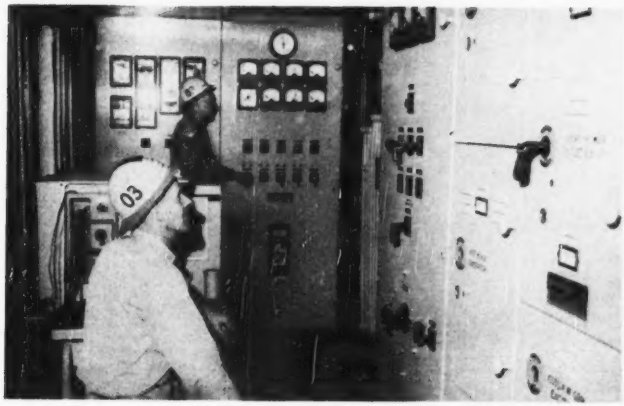
Cannelton to Pay More

Cannelton, Ind., large power users will pay about $200 a month more under a new contract agreed upon by the town and Tell City, which buys energy from Southern Indiana Gas & Electric Co, Evansville, and sells it to Cannelton.



CONTROL CAR of the U. S. Navy power train which has been sent to Mexico City

If Missouri Co-op Gets REA Loan, SPA Will Lease Lines, Sell Power

SOUTHWESTERN Power Administration has contracted to lease lines and market power in northwestern Missouri when and if the Rural Electrification Administration approves a controversial multi-million dollar loan to a new super co-op, NW Electric Power Cooperative, Savannah, Mo.

The co-op's plans, understood to call for an initial loan of $11 million and ultimate expenditure of some $23 million, are now being considered by REA. No action is expected on the application for several weeks.

Meanwhile, five power companies in northwestern Missouri filed a statement with REA opposing the application. The companies are St. Joseph Light & Power Co, Missouri Power & Light Co, Missouri Public Service Corp, Missouri Gas & Electric Service Co, and Kansas City Power & Light Co.

Terming the proposed NW system plans "unsound," the companies charged that they would increase power costs to the co-ops, would not improve service over that now given by the companies, and would create an "unduly burdensome" debt on member distribution co-ops. Hydro-electric power, not a major factor in the area, could be distributed by the companies, they contended. In addition, the companies attached a report prepared by a Kansas City engineering firm which estimated that savings of $2,260,000 would accrue during the period 1953 to 1962 to the distribution co-ops involved if they continued to purchase power from the companies.

The NW-SPA plans call for a 154-kv line from Bull Shoals Dam in Northern Arkansas to a 40,000-kw steam generating plant, proposed for construction on the Missouri River near Missouri City. More than 400 miles of 69-kv lines would be constructed to distribute power to seven co-op members of NW. In addition, the new lines would interconnect with the systems of the Central Electric Power Cooperative of Linn and the Sho-Me Power Corp, Marshfield.

Under terms of the agreement with SPA, the lines constructed by the co-op would be leased by the federal agency at a rental sufficient to amortize the proposed REA loan. Power from the steam plant would be purchased by SPA. Similar arrangements are being negotiated by SPA with the Central and Sho-Me co-ops, which recently obtained REA loans totaling $13,350,000.

SPA also reported negotiations are continuing at Tulsa with companies on wheeling agreements for other federal power in the area. The Tulsa talks are now in their third month. The agency disclosed that it plans no quick action on disposing of power from Narrows Dam on the Little Missouri, a tributary of the Ouachita River in Southwestern Arkansas. Power operations are scheduled to start at Narrows next October, and Southwestern Gas & Electric Co has offered to wheel energy from the dam under a contract based on the SPA-Texas P & L contract.

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More Water for Power Goal of Canada, U. S.

Formal negotiations for revision of a 40-year-old treaty between the U. S. and Canada will get under way next year, the State Department has announced. Aim of the new treaty talks: more water diversion for more power from the Niagara river.

Three-day exploratory talks last week in Washington were pronounced satisfactory, and the complicated business of rewriting the 1909 apportioning of Niagara water will start in earnest next year. Basis of the talks was a report by the U. S. Federal Power Commission's Bureau of Power Chief, E. Robert De Luccia, published in October (EW, Oct 29, P 5). Progress in the continuing exploratory talks indicates probable agreement on two major suggestions of the FPC report:

1. A 50-50 sharing of the water diverted for power. Under the old treaty Canada is allotted a larger amount.

2. More water for more power can be taken from the Niagara River by both nations than is now being done without endangering the scenic beauty of the falls.

Adrian S. Fisher, Department of State legal advisor, headed the U. S. group participating in the exploratory talks, and the group included De Luccia and Col. W. E. Potter, acting Assistant Chief of Engineers for Civil Works, Corps of Engineers. Gerald V. Cruise, chief engineer of the Power Authority of the State of New York, and Edwin S. Bundy, vice-president of the Niagara Hudson Power Co, served as technical assistants.

W. D. Mathews, Minister at Washington, headed the Canadian group, which included: K. A. Burbridge, acting chief of Legal Division, Department of External Affairs; N. Marr, acting controller and chief engineer of Dominion Water and Power Bureau, Department of Mines and Resources; G. A. Lindsay, engineer in charge, Department of Transport; R. Saunders, chairman of the Ontario Hydro-Electric Commission; and C. Daly, Minister of Labor, Ontario Province.

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Ohio Edison Buys Site

Ohio Edison Co has purchased the Empire Steel Co site on the Mahoning River at Niles for a generating plant if the need develops.

VICE-PRESIDENT J. Shirley Gracy, left, congratulates R. V. Peyinghaus, a $50-bond winner

Florida Power Makes Safety Pay-Out in Cash

A combination of personal safety and financial profit—that's the formula Florida Power Corp used to reduce its summer accident rates this year.

The utility ended a 16-week summer contest with a record of no fatalities and only five lost-time accidents, compared to one fatality and 15 disabling accidents for the same period in 1948. Lost working days totaled 161; for the summer of 1948 they were 268. This reduction was made despite a personnel increase of approximately 10%.

The accident-cutting contest was the product of an idea by Vice Pres J. Shirley Gracy, head of the personnel department. Even though Florida Power had won first place in the Southeastern Electric Exchange Accident Prevention Contest for 1948, he wasn't satisfied with its accident rates. The summer months seemed to be the heart of the problem. During the five years ended with 1948, 41% of the company's disabling accidents had occurred during June, July, August, and September, and these had accounted for 63% of its accident costs.

So Gracy and Safety Director H. B. McMahan decided to share with employees the saving that accident reduction would bring in insurance costs. They set up a fund of $6,000 in savings bonds, to be distributed to employees at the end of the period from June 11 through Sept 30.

Eight hundred employees in "field operating" jobs participated. The fund was reduced $250 for each lost-time accident. A fatality would have cut it by $2,000. Any employee who had a lost-time accident lost out in the distribution.

Before long, McManus reported, employees were keeping critical eyes on each other's procedures—"You tryin' to lose a couple of grand outa' the kitty?" Final value of the contest fund, distributed Oct 15, was $5,000. One lost-time accident involved a casual laborer, and deduction was not made.

Idaho Power Co Asks Rehearing on FPC Order

Idaho Power Co has asked the Federal Power Commission for rehearing on FPC's order requiring the company to wheel federal power on transmission lines being constructed from its Bliss hydroelectric plant.

In a petition for rehearing the company charged that the Commission's Oct 13 order violated the U. S. Constitution.

"Unreasonable and arbitrary" conditions and requirements of the order, as described in the petition, include: conversion from 138-kv to 230-kv lines at the request of the Secretary of Interior; competitive use of the lines by the Government; negotiation provisions for interconnections; requirement of 30-months notice by the company for withdrawal of capacity from government use; and "indefinite and uncertain" provisions.

Changes in Capacity Reported to Federal Power Commission

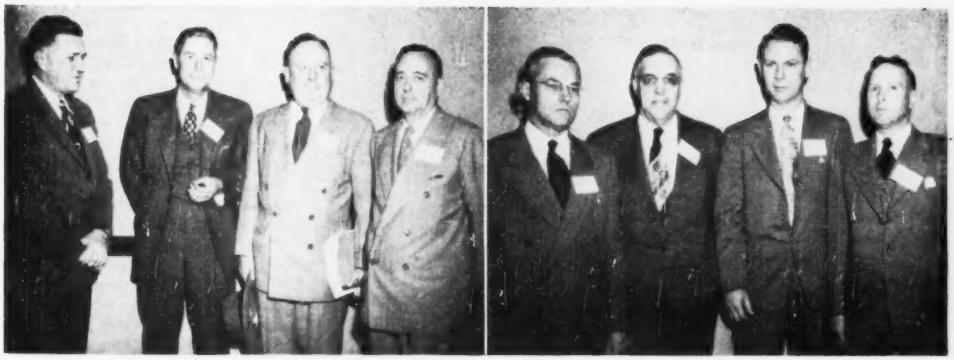
PLANT ADDITIONS DURING OCTOBER

Utility	Plant	Fuel	Capacity (Kw)
Consolidated Edison Co. of N. Y.	Waterside	S	50,000
Paul Smiths Electric Light, Power & Railroad Co. (N. Y.)	Piercefield #2	IC	2,000
Public Service Electric & Gas Co.	Sewaren, N. J.	S	100,000
Pennsylvania Power & Light Co.	Sunbury	S	75,000
West Penn Power Co.	Mitchell	S	74,750
Ohio Edison Co.	Toronto	S	60,000
Columbus & Southern Ohio Electric Co.	Poston	S	40,000
Waterville Light & Power System	Waterville, O.	IC	450
L'Anse Electric Department	L'Anse, Mich.	IC	392
Thumb Electric Co-op. of Michigan	Caro	IC	2,338
Northern States Power Co. (Minn.)	Bison No. 1	S	4,000
West Bend Municipal Light Plant	West Bend, Ia.	IC	600
Iowa Power & Light Co.	Des Moines #2	S	5,000
Iowa Power & Light Co.	Oskaloosa	IC	1,160
Onawa Electric Light & Power Department	Onawa, Ia.	IC	1,000
Chillicothe Municipal Utilities	Chillicothe, Mo.	S	5,000
Lakota Light & Power Department	Lakota, N. D.	IC	300
Otter Tail Power Co.	Devil's Lake, N. D.	S	7,500
Otter Tail Power Co.	Devil's Lake, N. D.	S	5,000
Central Kansas Power Co.	Wakeeney	IC	1,200
Central Kansas Power Co.	Atwood	IC	600
Central Kansas Power Co.	Hoxie	IC	600
Western Light & Telephone Co.	Ness City, Kan.	IC	1,250
Western Light & Telephone Co.	Coldwater, Kan.	IC	240
Accomack-Northampton Electric Co-op.	Parksley, Va.	IC	875
Harrisonburg Electric Department	Harrisonburg, Va.	IC	1,680
Potomac Electric Power Co.	Potomac River (Va.)	S	80,000
Hope Water & Light Plant	Hope, Ark.	S	1,500
Heber Light & Power Plant	Snake Creek, Utah	H	800
Elko Lamoille Power Co.	Elko, Nev.	IC	1,000
Burbank Public Service Department	Burbank, Calif.	S	20,000
Southern California Edison Co.	Redondo Beach #1	S	60,000
Bureau of Reclamation	Keswick, Calif.	H	25,000

PLANT RETIREMENTS DURING OCTOBER

Public Service Electric & Gas Co. (N. J.)	Marion	S	9,000
Waterville Light & Power System	Waterville, O.	IC	72
McLeansboro Light & Power Plant	McLeansboro, Ill.	S	1,250
New London Utility Commission	New London, Wis.	IC	300
Otter Tail Power Co. (Minn.)	Hoot Lake	S	1,500
Iowa Power & Light Co.	Missouri Valley	S	300
Chillicothe Municipal Utilities	Chillicothe, Mo.	S	1,500
Otter Tail Power Co. (Minn.)	Devil's Lake	S	5,000
Central Kansas Power Co.	Wakeeney	S	180
Central Kansas Power Co.	Atwood	IC	136
Western Light & Telephone Co.	Medicine Lodge, Kan.	IC	240
Accomack-Northampton Electric Co.-op.	Parksley, Va.	IC	200
Alachua Electric Department	Alachua, Fla.	IC	92
Arkansas Power & Light Co.	Des Arc	IC	50
Elko Lamoille Power Co.	Elko, Nev.	IC	250

H—Hydro, IC—Internal Combustion, S—Steam.
United States Capacity as of Nov. 1—Steam, 43,043,394 kw; Internal Combustion, 1,731,253 kw; Hydro, 16,391,638 kw; Total, 61,166,285 kw.



POWER DISTRIBUTION Conference at University of Texas brought together, left to right, B. M. Gallaher and G. W. Bean, Texas Electric Service Co; R. J. Foley, San Antonio Public Service Board; and H. E. McDowell, Ebasco Services, Inc. In right panel, left to right, are Bryce Brady, Oklahoma Gas & Electric Co; A. E. Beattie, Gulf States Utilities Co; A. A. Johnson, Westinghouse Electric Corp; Prof N. F. Rode, Texas A & M. The conference is sponsored annually by the University at Austin

Trend to Multiple Street Lighting Reported at Distribution Conference

THERE IS A trend toward multiple street lighting. Today 35% of street lighting material being purchased is for multiple lighting and 65% for series lighting. The old ratio was 10% and 90%. It is likely that in the future the ratio will be 25% and 75%.

These were the comments of K. D. Tobin, General Electric Co, at the Power Distribution Conference, Dec 8, at the University of Texas.

Summarizing distribution practices, H. E. McDowell, Ebasco Services, Inc, reported an unquestionable trend toward universal use of 12-kv distribution; a reluctance to accept lower impulse insulation, based on failures, the causes of which are being corrected; that the trend, however slow, is definitely favorable to the banking of transformers; and that increasing number of flicker complaints probably will accelerate adoption of transformer banking.

He also reported that the relay-fuse coordination scheme of protection has marked a new era in distribution practice and that records of its excellent results provide proof of its superiority over older protective schemes. Since nearly all faults are single-phase to ground, neutral impedance to limit fault currents to ground offers a low-cost solution to the problem of higher short-circuit duties on the distribution system.

H. R. Sharpless, Gulf Oil Corp, said that an inadequately planned power distribution system in a large industrial plant can be improved by correcting the inadequate interrupting capacity by the installation of current-limiting fuses or alternate devices.

Reviewing overcurrent protection practices on distribution systems, G. G. Auer, General Electric Co, asserted that if the basic time-current curve similar to that of the primary fuse link can be obtained in all the overcurrent devices to be coordinated, reliable coordination can be assured. He said that this goal is finally becoming a reality.

A study of 112 seniors studying electrical engineering revealed that when they get their first jobs they will expect broad training to help them find their fields of greatest interest. Prof. B. N. Gafford, University of Texas, who presented the survey results, added that most of the men indicated that they had not yet determined these fields.

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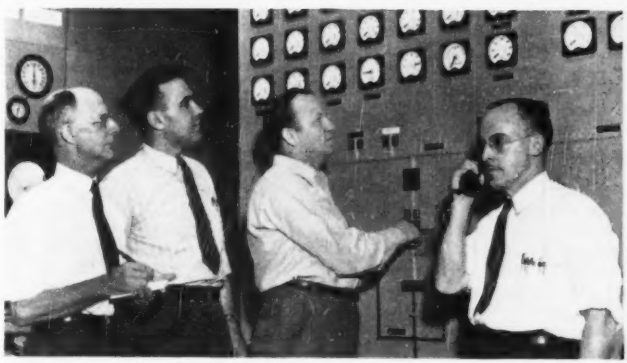
Florida P&L to Build Plant

Construction will begin in January on a $10-million Florida Power & Light Co steam plant on the St. Johns River at East Palatka. Ultimate capacity will be 66,000 kw, which will make the plant one of the largest in the company's system. The initial 33,000-kw unit is scheduled for operation by the summer of 1951, with another to be completed in 1955. The plant will provide a safe reserve margin.



AT CONTROLS as West Penn Power Co placed its second 80,000-kw unit on the line at Mitchell Station were J. E. Thomas, left, chief engineer of power plants; R. E. Weber, station superintendent; W. J. Howells, control operator; and Floyd Drummond, supervisor of operations

JUNE IN DECEMBER came to New York recently when this group of Florida Power Corp executives, resplendent in white palm beach, met a group of 91 investment bankers, insurance company officials, and security analysts to escort them southward for a "bankers' tour" of the company's system. President A. W. Higgins, center, headed the delegation

New SEC Head Indicates No Break with Past Policies, Will Stick to U-50

DON'T LOOK for any drastic policy shifts in public utility regulation under Securities and Exchange Commission's new Republican chairman.

Harry A. McDonald, first Republican ever to head SEC, gave the industry its first glimpse of his program in a recent speech to the Investment Bankers Association of America at Hollywood, Fla. That glimpse indicated a picture not very different from that of the Democratic past.

For example, McDonald put a damper on utility and investment banker hopes for modification of SEC Rule U-50, requiring competitive bidding on public utility security issues. He indicated the Commission was happy with U-50 and wasn't considering any major changes.

Investment and utility spokesmen have urged a moratorium on the rule, at least so far as common and preferred stocks are concerned. They argue that competitive bidding prevents the seller from picking the most propitious time to offer his stock and interferes with the individualized marketing of stocks needed in a tight market. An underwriting house can't spend the time and money necessary to develop the best market unless it is sure of being the underwriter for the issue, they claim.

SEC is not swayed by these arguments. The Commission's thinking on the U-50 issue seems to be about as follows:

No substitutes have been proposed that would satisfy legal requirements for maintenance of competition and reasonable sale prices and underwriting spread. SEC can and does make exemptions when and where it feels they are warranted.

The Commission contemplates no moratorium on U-50, no blanket exemption of stocks, and no upping of the exemption on debt transactions (now $1 million in any one calendar year). Actually it can and does use all three when the need arises. For example:

1. Exemptions from U-50 were granted freely in 1947, when it was hard to get bids on stock issues. Today's situation is different, SEC feels. Examples cited by SEC as indicating improved market conditions within recent weeks include four bids for $22 million of American Gas & Electric Co common stock, three or four for $17 million of Southern Co common.

2. Stocks have been exempted more often than bonds through the years of U-50's operation. But, SEC argues, exemption is considered on the basis of each issue and the market conditions. The higher proportion of exemptions on stocks does not demonstrate a need for amending the rule.

3. The present bond exemption figure is generally satisfactory, SEC has found. Where exceptions need to be made, they can be. Some issues of slightly more than $1 million have been exempted and even larger ones have been in some cases. For instance, exemption might be made for a company that had never been through registration before and lacked accounting data for statement.

When exemption to U-50 is granted, "shopping-around" negotiation, modified competitive bidding, and other devices have been suggested by investment bankers, companies, and SEC. The Commission's feeling is that the factors arguing for exemption also will influence choice of the alternative.

FINANCIAL BRIEFS

A new arbitraging wrinkle was illustrated by Blyth & Co's purchase of most of Northern States Power Co of Minnesota's 200,000-share stock issue this week. The banking house, a non-underwriter, bought rights in the open market and invoked the accompanying special subscription privileges. Market price was 11; subscription price for additional shares was 10¼.

Voters of Angelton, Tex., recently defeated two bond issues totaling $500,000 which were proposed to finance city-owned ellectric and gas utilities. The defeated municipal power plant and distribution system would have been in competition with Community Public Service Co, Fort Worth. The company has a franchise that extends to 1979.

Reliance Electric & Engineering Co raised its first quarter dividend to 62½¢, payable Jan 31 to stock of record Jan 20. Last year three quarterly dividends of 50¢ were paid as well as a year-end of 75¢ Oct 31.

Additional shares of common stock will be offered to present Southwestern Public Service Co stockholders on a one-for-eight basis early next year. The company plans to raise about $18 million in the fiscal year ending Aug 31 to help finance its $20-million expansion program for the year. Most of the funds will be provided by sale of $10 million of 30-year mortgage bonds, already arranged privately, and part through sale of some $2.5 million of debentures. The company also is considering refunding some of its privately held indebtedness.

5.88 Billion Kwhr in Week Sets Production Record

Electric power output hit its highest point in history for the week ended Dec. 10.

The nation's central stations distributed a total of 5,881,360,000 kwhr last week, at last topping the record of 5,810,034,000 kwhr set the week ended Jan 29. With the pre-Christmas season still here, the present record is expected to be a short-lived one. Chances are it will topple this week. Output looks likely to pass the 5.9-billion kwhr mark before the end of the year.

Output for the week of Dec. 10 was 3.1% above the corresponding week of 1948, when 5,704,823,000 kwhr was distributed. For the week ended Dec 3 output was 5,742,915,000 kwhr.

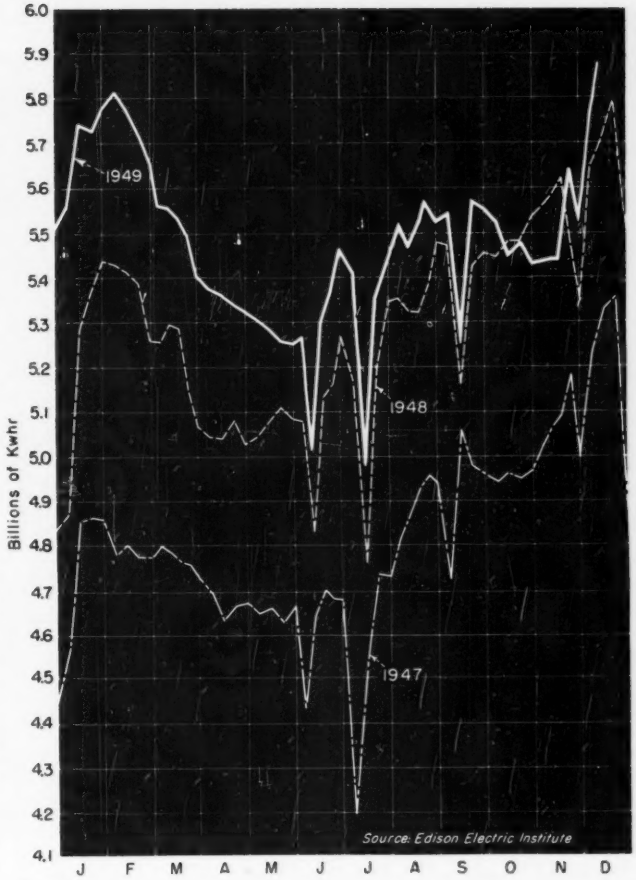
Every region of the United States showed a jump over the corresponding period last year.

Weekly Output, Million Kwhr

1949		1948		1947	
Dec 10	5,881	Dec 11	5,705	Dec 13	5,327
Dec 3	5,743	Dec 4	5,646	Dec 6	5,218
Nov 26	5,537	Nov 27	5,349	Nov 29	4,983
Nov 19	5,644	Nov 20	5,627	Nov 22	5,180
Nov 12	5,435	Nov 13	5,571	Nov 15	5,084
Nov 5	5,435	Nov 6	5,564	Nov 8	5,057
Oct 29	5,433	Oct 30	5,555	Nov 1	5,009
Oct 22	5,430	Oct 23	5,539	Oct 25	4,964
Oct 15	5,481	Oct 16	5,482	Oct 18	4,946
Oct 8	5,450	Oct 9	5,482	Oct 11	4,958
Oct 1	5,521	Oct 2	5,449	Oct 4	4,935
Sept 24	5,556	Sept 25	5,461	Sept 27	4,956

Percent Change from Previous Year

	Dec 10	Dec 3	Nov 26
New England	+ 6.9	+ 7.2	+ 7.4
Mid-Atlantic	+ 1.1	+ 1.0	+ 1.6
Central Industrial	+ 1.0	− 2.4	+ 0.5
West Central	+ 6.4	+ 5.8	+ 6.1
Southeast	+ 4.3	+ 4.6	+ 5.7
South Central	+ 9.8	+ 8.0	+ 8.1
Rocky Mountain	+ 0.1	+ 0.3	+ 2.1
Pacific Coast	+ 4.1	+ 1.3	+ 5.4
Total United States	+ 3.1	+ 1.7	+ 3.5



Chattanooga Cuts Down on Electric House Heating

The Chattanooga Electric Power Board is being forced to curtail conversion to electric house heating because of the sharp upward trend of the past few months.

During the past five years some 18,000 homes in the Tennessee Valley area have been electrically heated. There are some 5,600 homes in the Chattanooga area alone, of which 999 have been added in the past four months. The Chattanooga rate is so great that transformer capacity cannot be added at the same pace as requests for electric house-heating installations.

The recent coal strike and shortage of gas has stimulated the trend toward electricity. Installations in new homes have been allowed.

MEETINGS

American Society of Agricultural Engineers
Winter Meeting, Stevens Hotel, Chicago, Ill., December 19-21.

National Farm Electrification Conference
Stevens Hotel, Chicago, Ill., December 20-22.

Canadian Electrical Association
Annual Winter Conference, Chateau Frontenac, Quebec, January 16-18.

Plant Maintenance Show and Conference
Auditorium, Cleveland, Ohio, January 16-19.

★**Southeastern Electric Exchange**
Industrial Relations Conference, sponsored by Edison Electric Institute Industrial Relations Committee, SEE Personnel Administration Section, and Southwest Personnel Committee, Roosevelt Hotel, New Orleans, La., January 19-20.

Southwest Air Conditioning Exposition
Hall of Agriculture and the Poultry Building, Fair Park, Dallas, Tex., January 23-27.

American Society of Heating and Ventilating Engineers
Annual Meeting, Adolphus and Baker Hotels, Dallas, Tex., January 23-27

American Institute of Electrical Engineers
Winter General Meeting, Hotel Statler, New York, N. Y., January 30-February 3.

Edison Electric Institute
Electrical Equipment Committee, Netherlands-Plaza Hotel, Cincinnati, Ohio, February 13-14; Industrial Relations Committee, Palmer House, Chicago, Ill., February 16; Transmission and Distribution Committee, Statler Hotel, Detroit, Mich., February 20-21.

Pennsylvania Electric Association
Transmission and Distribution Committee, Penn-Harris Hotel, Harrisburg, Pa., February 16-17.

★**National Adequate Wiring Bureau**
Adequate Wiring Conference, Statler Hotel, St. Louis, Mo., February 16 and 17.

American Society for Testing Materials
Committee Week and Spring Meeting, Hotel William Penn, Pittsburgh, Pa., February 27-March 3.

★**National Rural Electrification Association**
Annual Convention, Hotel Stevens, Chicago, Ill., March 6-9.

★**National Electrical Manufacturers Association**
Edgewater Beach Hotel, Chicago, Ill., March 13-16.

* Additions This Week

WASHINGTON COMMENT

WILLIAM B. WHICHARD

MORE REGULATION of business is in the air, what with three separate Congressional committees digging into the matter from as many starting points. For a change, electric utilities are not directly involved in any of these investigations. But, indirectly, at least, the utility industry has an important, if not obvious, stake in legislation that conceivably could evolve from some of the probing.

Well worth the industry's watching are two Senate studies of financing, the one directed at federal fiscal policies and the other scouting the scarcity of venture capital in general. Either could lead to legislation having a regulatory effect on the utility industry's ordinary sources of capital.

Even closer to home, however, is the continuing study of so-called business monopolies by a House group headed by Rep Emanuel Celler. These hearings, which recently were suspended until next year, have centered their attention on industries outside the utility field. The inclusion of enterprises closely linked with electric utilities has appeared—and it probably was—strictly incidental to Celler's avowed purpose to investigate "big business" of all types.

It's this scope, this all-inclusive probing, that makes the Celler group so important to the electric utilities. Celler already has sniffed at some "big business" on which the utilities depend for their very existence—big investors in utility securities and big makers of power equipment. The apparent direction of this probing is ominous.

Celler seems to feel that "big business" has developed to the point where it can, and sometimes does, push around both its smaller competitors and the public. He is especially suspicious of the big manufacturing firms which control sources of the raw materials they use or which maintain their own merchandising outlets. In the financial field, he seems leary of any organization with vast funds to invest and some discretion in doing so.

He does not accuse such firms of defying, or even evading, the anti-trust laws. But he feels those statutes are not adequate to offset the sheer economic power of "big business" in relation to small business and the public. Abuses of both must occur, he holds, inadvertently or by design, as a natural result of "big business" operations.

Celler and other government people like him still are largely in the ground-testing phases of thinking along these lines. Their interrogation of witnesses, both representatives of "big business" and critics of the same, show they are looking for "abuses."

That's why testimony like that of General Electric's Charles E. Wilson (EW, Dec 10, p 11) is important—to industry large and small. For if Celler finds convincing evidence there is something intrinsically evil about "big business," he will demand legislation. This might be in the form of regulation patterned on the Holding Company Act, with ceilings on any company's holdings and activities. Or it might be a forthright ban on corporate size, based on earnings, proportion of production in any specific field, or some other standard. Both approaches already have been discussed.

So it is up to Wilson, and others really familiar with the workings and merits of "big business," to make a case that will stand up right now.

Otherwise, the utilities and other industries may wake up one, two, or more years hence to find their sources of money and equipment under federal control, with all the delay and red tape that implies.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Poles treated in 1948 were 84% full-length pressure treated; 82% were creosote treatments; 9% with creosote-pentachlorophenol. Decreases relative to 1947 were poles 31%; creosote and creosote-coal tar 8.6%; creosote-petroleum 33.5%; zinc chloride 52%; pentachlorophenol 58% (not 78% as in the 10/8 column); copper naphthanate 99%. Chromated zinc chloride gained 30% and Wolman salts 11%.

Capacitor progress is not hard to understand; today's unit cost is less than ¼ what it was 15 yr ago.

Economic interconnection operation means, basically, that local generation should be adjusted up and down with the local area load to minimize upset of prearranged transfer schedules.

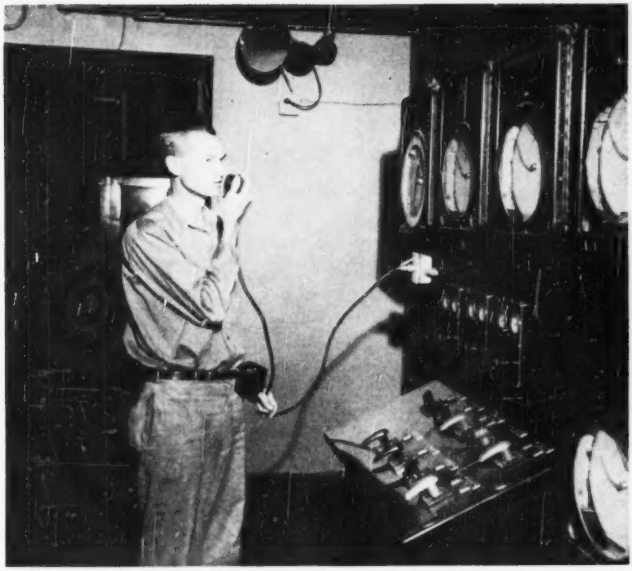
Mercury-steam cycle generation at Portsmouth is promised to be as efficient thermally as any plant of its size anywhere in the world.

Glass fabric is reported to have been substituted for the lead sheath in a recent gas-filled cable.

Telemetering, quite naturally, costs more as the desired speed of response is enhanced. Several seconds delay in indications can explain the hunting experienced when compensating adjustments are made in ignorance of the real system conditions.

Control-room dimension skimping may prove a boomerang when it turns out that operating economics calls for much more instrumentation than centralization of control could warrant for the sake of station availability.

Rubber gloves, used as conscientiously as prescribed by safety rules, would prevent one in five of the fatalities attributed to accidental contact.



INSTANT COMMUNICATION with all parts of the steam plant of Burbank Public Service Department is provided by plug-in microphones and loudspeakers of this type. Operator carries microphone and cord in leather case on belt, can plug in at any of 105 stations

Blanketing Intercom System Puts Zip Into Plant Operations

Better coordination of operating personnel increases utilization of available manpower, saving one man per shift in 20,000-kw plant

D. W. GRATZ
Public Service Department
City of Burbank, Calif.

BETTER COORDINATION of steam plant operation through the use of an extensive public address communication system can save one man per shift. After a full year's use of such a system incorporating 66 loudspeakers and 105 microphone stations in their 20,000-kva steam plant, the Burbank (Calif.) Public Service Department has also found it indispensable in routine operation as well as for emergency conditions.

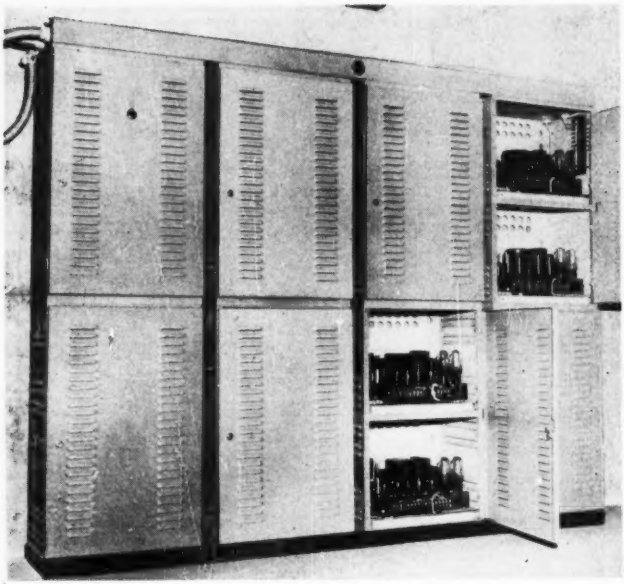
Location of the plant's two semi-outdoor turbogenerators outside the main building and on a different level from the boiler operating floor posed an operating problem for emergency conditions. An operating force adequate for normal operation appeared insufficient at times of emergencies or unplanned outages. Study disclosed that the basic difficulty was a lack of coordination of effort, due to inadequate means of intercommunication whereby operating orders and information could be quickly dispatched. Communication difficulties in the plant are common to many other similar plants, with noise levels of 95 to 105 db along the boiler aisles, and up to 125 db adjacent to draft fans.

Characteristics of a communication system suitable for operation in the plant were determined to be:

Noise Level—Ability to deliver communications with a high degree of intelligibility when sending and receiving in an ambient noise level up to 125 db.

Speed—Immediate location of personnel, with minimum time lost in reporting back when called by paging signal.

Accessibility—Receiving and sending of communication from and to



MAXIMUM RELIABILITY is provided by duplicate major components in this amplifier assembly, including automatic throwover to a standby source of a-c power supply

all points throughout the plant.

Reliability—Freedom from loss of intercommunication due to failure of any component of sound equipment or the regular source of power.

To meet these requirements, a system was installed using loudspeakers and plug-in microphones blanketing the entire plant and yard area. Total cost of the system was approximately $13,500, of which $8,500 was equipment, $5,000 installation cost.

Ability of the system to send intelligible communications from extremely noisy locations is due to the cancelation-type microphone used. The lips are held within ¼ in. of the microphone, and sounds coming from more than one inch away impinge on both sides of the transmitting diaphragm, thereby canceling. Each operator on duty carries, on a belt hook or in a carrying case, a microphone equipped with a 4-ft cord which he can plug in at any of the 105 stations throughout the plant.

The stations are six-prong receptacles mounted on wall plates with a spring-return cover for protection from moisture and dust. They are located eight feet apart on control boards and instrument panels. Along aisles and at equipment, spacing of 12 to 25 ft is used, depending on relative time spent by an operator in such areas. Stations are also located at strategic points in the yard area. As a result, an operator will generally be within 10 ft of a station 90% of the time, and within 25 ft 99% of the time.

Loudspeakers

The 66 loudspeakers, which all operate simultaneously, blanket the entire plant and yard area with each communication. Loudspeakers in closed rooms are wall-type cone speakers. For general plant coverage, 56 narrow-beam speakers rated 12 w each are used. Open deck and yard areas are covered by wide-angle horns. Speakers in the switchrack and on cooling towers are switched on and off by operators as they enter and leave to minimize spill-over of sound into an adjacent residential area.

Location of speakers was determined by trial, with adjustments and changes to provide the required degree of coverage being accomplished by varying output volume and spacing between horns. All horns are connected in parallel through a radial system of 500-ohm line, with each loudspeaker having its own matching transformer.

Intelligibility of communication even in the noisiest parts of the plant, has been proved in the year of successful operation of the system

With the large number of small horns all beamed in the same general direction, an operator walking through the plant is covered to a great extent by individual horns. In overlapping zones, horns are close enough to minimize reverberation.

The 500-w amplifier assembly includes twin driver amplifier units, twin 24-v d-c supply units, ten 50-w power amplifier units, and various relays and miscellaneous items, all housed in steel cabinet compartments. Reliability of the amplifier is assured through use of duplicate units operating in parallel. The amplifiers are in "stand-by" position at all times, with plate circuits closed by plugging in any microphone. Automatic throwover to a standby a-c supply, permits uninterrupted use of the intercommunicating system even in event of a general power failure in the plant.

Biggest advantage of the system is that no time is lost in establishing contact with the wanted party. In case of emergency, the operator can be receiving instructions during the time he is running to the point of trouble, acknowledging them when he arrives. If the chief operator is in another part of the plant he can cut in and amplify or change the orders as he sees fit. It is never necessary to leave a control board or instrument panel to deliver or receive information of any kind.

Although the system was originally investigated as a means of coordinating manpower during emergency operation, it has now assumed major importance in routine operation. Since each operator hears all communications, he is at all times aware of conditions throughout the plant. The fireman now can anticipate an order from the steam engineer when the electric operator announces a major change in load. Again, routine shutdown of a turbogenerator unit was formerly scheduled only at times of shift change with the outgoing shift held over until the shutdown was completed. With the greater coordination possible through use of the intercommunicating system, routine shutdowns are now scheduled without regard to shift-change and extra manpower.

Gang Test Is Cheaper for Rural Meters

J. C. LANGDELL
The Commonwealth & Southern Corp
Jackson, Mich.

UP TO a few years ago, the general practice in periodic testing was that tests should be made on the customers' premises. Due the greater use of socket type meters and other outdoor enclosures, many companies have found it more practical to remove these meters, especially the socket type, and test them in the shop. It has been found, also, that all self-contained meters may be economically tested in this manner under a number of conditions. Efficiency of this procedure has been greatly increased by the design and operation of automatic test panels which provide means for handling these meters much faster in the shop than on the customers' premises. Speed of two types of shop test panels is compared in Table I.

Cost of this type of testing is very little, if any, more than the cost of testing meters on the premises. In fact, it is materially less where customers are located in sparsely settled rural areas where costs are highest, and that over-all testing costs may average less over the entire system. See Table II.

Shop testing has many advantages over testing on the customers' premises. Some of these advantages are as follows:

1. Less annoyance to the customer.

2. Possible check of the register when required.

3. The insulation of the meter can be tested by applying high voltage on both potential and current windings. This to a large extent minimizes future meter burnouts in service.

4. Complete overhauling can be made, including painting where necessary.

5. No lost days due to climatic conditions.

6. Due to the great increase in customers' loads, we are finding a large number of meters with charred current coils in the 5-amp, 2-wire types. This item alone can justify this method of meter testing.

Distance should be given some study as to how far one can justify the removal of meters for test in a central shop. We feel that 75 miles is about the maximum distance meters should be transported. How large a division should be before a separate meter department unit should be set up depends upon many factors, and it is necessary to analyze each case on its own merits. In most cases, a unit can be profitably set up where it is necessary to maintain about 2,000 to 3,000 meters yearly, based on employment of a meterman and, of course, varying with meter location and operational set-up.

Every effort should be made to minimize, so far as possible, the maintenance of meters on customers' premises where it is necessary to pay the cost of maintenance away from home for the metermen. Our highest costs today are in the areas where we have not worked out plans for meter removal to a central shop.

Each company should set up a summary meter accuracy report, for in no other way can the company know whether the meters are being properly maintained.

TABLE I—Average Shop Meter Testing Rates Per Day Per Man

Data from one division of a company. This division handles about 50,000 meters in service out of this shop

	Bottom Connected Meters					
	Single Test Board		Gang Test Board*		Socket Type Meters	
	2 wire	3 wire	2 wire	3 wire	Single Test Board	Gang Test Board*
New Meters**					25–30	60–72
Periodic Tests	17	15	30	24	18	36

* The gang boards are 6 position boards.
** Includes checking registers, as found test and as left calibration.

Periodic Tests includes the following:

a. Check for creep.
b. As found test at Full Load, Light Load, and Inductive Load.
c. Posting data to history card.
d. Registers removed, checked for ratio, cleaned and set to zero.
e. Bearing maintenance and general interior cleaning.
f. Reassembly of meter and check of screws for tightness.
g. As left calibration on the three loads and posting of data
h. Removal of completed meters to "out" racks.

These testers usually make no repairs, wash no covers, do not clean meters on outside, do not make the over-potential test of insulation, and do no painting. These functions are done by others.

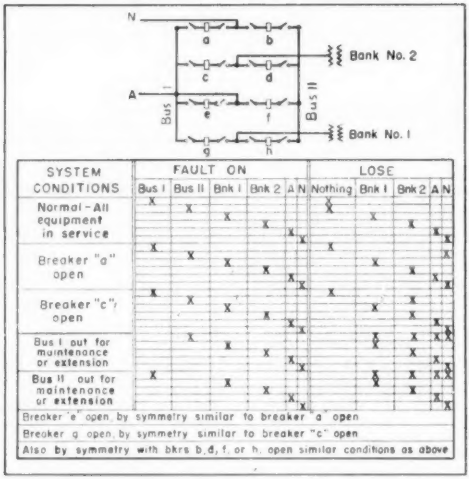
TABLE II—Cost of Single Phase Meter Testing Per Meter

	"A" Division		"B" Division	
House Testing	City	Rural	City	Rural
Testing Meter	.885	.885	.77	.96
Cost of Car	.125	.58	.28	.36
Testing Equipment Repairs	.05	.05	.08	.08
	1.060	1.415	1.13	1.40
Testing in Shop—Single Board				
Testing	.77	.77	.62	.74
Installer	.35	.35	.41	.41
Car	.20	.23	.17	.20
Records	.15	.15	.08	.08
	1.47	1.50	1.28	1.43
Testing in Shop—Gang Board				
Testing	.41	.41	.46	.58
Installer	.35	.35	.41	.41
Car	.20	.23	.17	.20
Records	.15	.15	.08	.08
	1.11	1.14	1.12	1.27

Note: These costs are on the basis of direct labor, automobile, and incidental expense only and do not include overheads.

In the "B" Division, one meter installer with one meter car will exchange on an average, winter and summer, about 22 meters per day for periodic test. This includes widely scattered rural territory as well as the more concentrated urban areas. Meters at present run about 50 percent socket types. With all socket meters, the average is expected to approach 30 meters per day. In the widely scattered rural and resort areas, the average is about 10 meters per day. This includes an inspection of each location for current diversion and other sources of trouble; also includes loading and unloading of the car together with making the necessary records.

* Excerpted from paper at recent meeting of engineering and operation section of Southeastern Electric Exchange



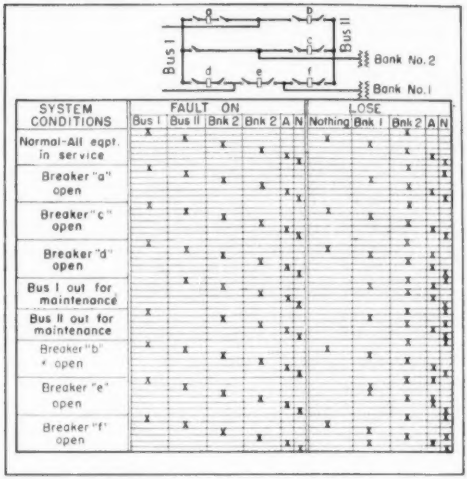
SYSTEM CONDITIONS	FAULT ON					LOSE				
	Bus I	Bus II	Bnk 1	Bnk 2	A N	Nothing	Bnk 1	Bnk 2	A N
Normal - All equipment in service	X	X	X	X	X X	X	X	X	X X
Breaker "a" open	X	X	X	X	X X	X	X	X	X X
Breaker "c" open	X	X	X	X	X X	X	X	X	X X
Bus I out for maintenance or extension	X	X	X	X	X X	X	X	X	X X
Bus II out for maintenance or extension	X	X	X	X	X X	X	X	X	X X

Breaker "e" open, by symmetry similar to breaker "a" open

Breaker g open, by symmetry similar to breaker "c" open

Also by symmetry with bkrs b, d, f, or h, open similar conditions as above

FIG 1—SWITCHING SCHEME shown meets tabulated requirements but needs more breakers than arrangement shown in Fig 2



SYSTEM CONDITIONS	FAULT ON					LOSE				
	Bus I	Bus II	Bnk 2	Bnk 2	A N	Nothing	Bnk 1	Bnk 2	A N
Normal-All eqpt. in service	X	X	X	X	X X	X	X	X	X X
Breaker "a" open	X	X	X	X	X X	X	X	X	X X
Breaker "c" open	X	X	X	X	X X	X	X	X	X X
Breaker "d" open	X	X	X	X	X X	X	X	X	X X
Bus I out for maintenance	X	X	X	X	X X	X	X	X	X X
Bus II out for maintenance	X	X	X	X	X X	X	X	X	X X
Breaker "b" open	X	X	X	X	X X	X	X	X	X X
Breaker "e" open	X	X	X	X	X X	X	X	X	X X
Breaker "f" open	X	X	X	X	X X	X	X	X	X X

FIG 2—ALTERNATE switching scheme meets same requirements as Fig 1 but will not lose entire station and uses two less breakers

Charts Compare Performance

Less costly schemes sometimes give more assurance of service continuity than layouts requiring more breakers. These charts and tabulations of comparative performance show advantages of alternate schemes

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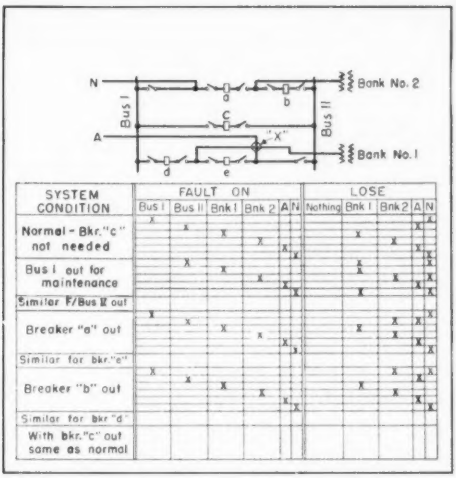
THERE ARE several generally-accepted basic switching arrangements; viz, the single bus, the main-and-transfer bus, the ring-bus, the breaker-and-a-half scheme, and the double-breaker double-bus scheme. Each arrangement offers certain advantages and has certain limitations. The logical way to select a switching arrangement is to study and compare the results obtained and the costs involved, with the various arrangements. Often the scheme adopted for solution of a particular problem will be a combination of one or more of the basic arrangements.

Six Breakers Better Than Eight

As an example, consider the problem of supplying a relatively important load for which a high order of service continuity is to be provided. In this, as in all problems of this nature, certain calculated risks must be admitted. It is accepted that low tension switching and load conditions will permit short interruptions of one of the two transformer banks with loss of service to the consumer. High tension busses are to be supplied by two heavy, well-designed, 154-kv transmission lines, either of which can supply the total load. One of the calculated risks that must be tolerated is the occurrence of simultaneous faults on these transmission lines. But it will only be necessary to provide against service interruptions caused by one fault at a time. Moreover, assume that oil circuit breakers must be removed from service periodically for maintenance purposes, and perhaps under emergency conditions to replace damaged equipment. Furthermore, it will be necessary on rare occasions to remove bus sections for replacement of insulators, extensions, and for other reasons. It is also required under these conditions that no interruptions occur in event of a fault while such equipment is out of service for maintenance or repair.

As a preliminary approach to the problem, the double-bus arrangement, Fig 1, will be investigated. While this arrangement is a perfectly standard arrangement and would be generally accepted as adequate for any purpose, the comparative performance table indicates that if a bus fault or breaker misfunction occurs while either bus is out of service for maintenance, the entire station will be lost, and, thus, this switching arrangement does not satisfy the conditions outlined above as being acceptable.

As a second attempt, consider the switching arrangement of Fig 2. This scheme uses two less oil circuit breakers, however, examination of the tabulation shows that this scheme



SYSTEM CONDITION	FAULT ON					LOSE				
	Bus I	Bus II	Bnk 1	Bnk 2	A	N	Nothing	Bnk 1	Bnk 2	A	N
Normal - Bkr. "c" not needed	X	X	X	X	X	X		X	X	X	X
Bus I out for maintenance		X	X	X	X	X		X	X	X	X
Similar F/Bus II out											
Breaker "a" out	X	X	X	X	X	X		X	X	X	X
Similar for bkr. "e"											
Breaker "b" out	X	X	X	X	X	X		X	X	X	X
Similar for bkr "d"											
With bkr. "c" out same as normal											

FIG 3—FEWER BREAKERS are required here, tabulation shows, but crossing at "X" is impossible on a conventional 161-kv structure

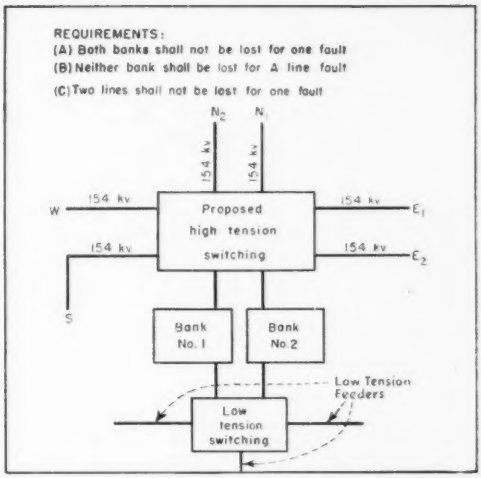


FIG 4—SWITCHING for this principal supply point having six 154-kv feeds was worked out as in Fig 5 to meet requirements

Of Alternate Switching Schemes

is superior to that of Fig 1 in that under none of the assumed conditions is the entire station lost due to faults.

It will occur that a number of variations of these two examples are possible; for instance, it is obviously possible to install by-pass disconnecting switches around any or all of the breakers and the advantages of these can be studied for the schemes shown. Of course, other arrangements employing fewer or more breakers are possible and different operating conditions can be considered.

Structural Features Important

The example just cited is a good illustration of the situation in which planning engineers often find themselves in regard to utilizing equipment. The switching arrangement of Fig 2 adequately solves the problem at hand. Another arrangement, using one less oil circuit breaker, that will provide about the same degree of reliability is shown on Fig 3. The difficulty encountered with it, however, is one of design of structure. It is physically impossible to make the encircled crossing marked "X", on the conventional type of 161-kv switching structure.

Various considerations must be investigated before a decision is made to use an unusual construction. Some of these considerations involve limitation of future extensions, clearances required, and ease of maintenance. For instance it might be entirely practicable to so locate transformer bank No. 1 that its pull-off would not interfere with the pull-off of line N, but since this would be an "unusual" arrangement and might, at some future date, interfere with bus extensions and the termination of other lines and banks, it is sometimes decided that the expenditure required for installation of an additional breaker is fully justified even though the additional breaker adds nothing initially to service reliability.

Consider Other Schemes

As a further example of the analysis of switching arrangements, consider a station which is a combination of a heavy switching station, a principal supply point for an extensive medium-voltage network and a major supply point for a relatively large municipality. At this station, shown in the block diagram, are terminated six heavy 154-kv lines which bring power to and carry power from the high tension busses. These lines are designated S, E_1, E_2, W, N_2 and N_1. Two large banks of transformers are to be supplied from the 154-kv buses, either bank being capable of carrying the entire load of the connecting low tension system for a short time. Loss of either of the "N" lines and more than one of the other lines, due to one fault, would result in system instability. This must be faithfully guarded against.

Requirements of the 161-kv switching for such a station can be summarized as follows:

1. Both banks shall not be lost for any one fault.

2. Neither bank shall be lost for any line fault.

3. Two lines shall not be lost for any one fault.

These requirements must be met even if one breaker or one bus section is out of service for maintenance. After construction of diagrams of numerous switching arrangements and many tabulations,

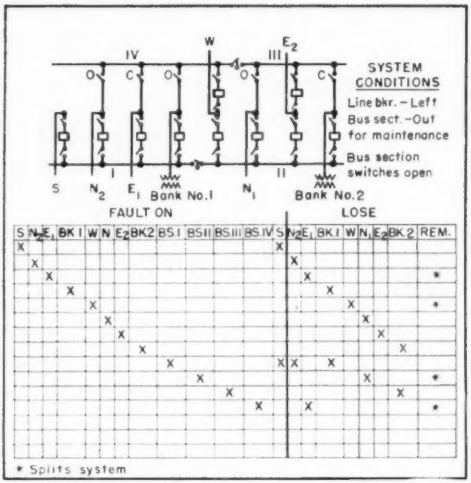


FIG 5—BEST SWITCHING SCHEME for the substation of Fig 4 is shown, being considered an arrangement which will satisfy the requirements tabulated, with the installation of minimum equipment

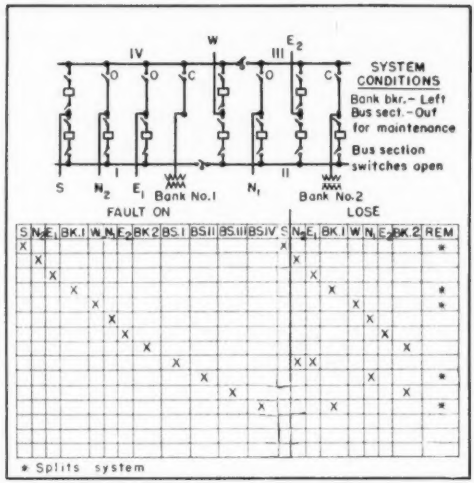


FIG 6—ALTERNATE SCHEME for the supply point in Fig 4 considers conditions with one line breaker in left section out for maintenance, bus section switches open. Expected performance tabulated

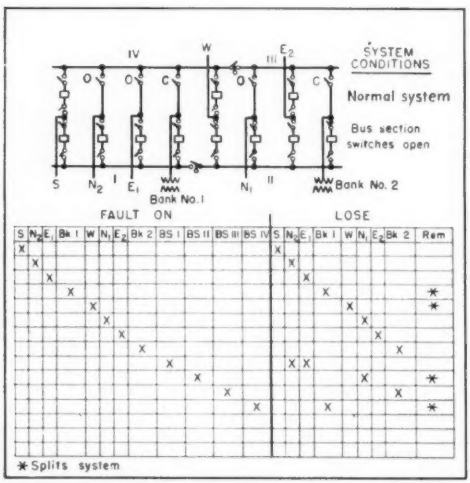


FIG 7—ANOTHER SCHEME with equipment out for maintenance, meets the requirements for switching center in Fig 4, tabulations show

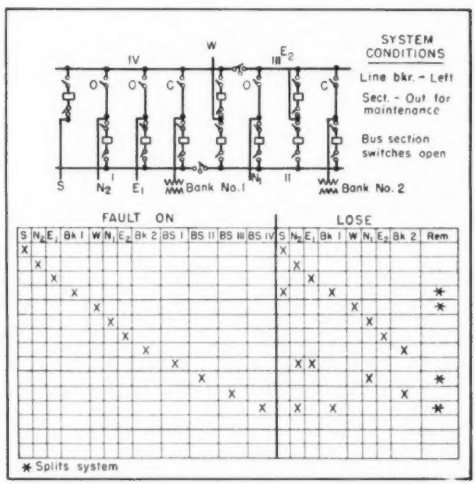


FIG 8—STILL ANOTHER SCHEME shows changed conditions and different switching arrangement. Results are shown by tabulations

the basic switching arrangement of Fig 5, is considered to be an arrangement which will satisfy the requirements with the installation of a minimum of equipment. Figures 6–8 inclusive, show various abnormal conditions in which different pieces of equipment have been removed from service. In each of these arrangements it can be seen that the basic requirements of the problem have been met.

There are, it is true, a large number of possible arrangements of four bus sections and 11 oil circuit breakers. However, it is believed that fewer breakers could not be used in the solution of this problem than are shown in Fig 5 and yet provide the same degree of reliability. Further study will show that the conditions under which system splits occur could be minimized or eliminated by the addition of about two more breakers. Whether or not these breakers would be justified is purely a matter of relative economics. The cost of adding two breakers being possibly in the order of $100,000 to $150,000.

After deciding upon the switching arrangement which is adequate and economical, an additional problem concerning the low-tension switching in such a station would remain to be solved using methods similar to those used in previous examples.

Banked Secondary System Uses Breakers Or Fuses Alternatively

Colorado utility uses magnetic CB's for junctions with relatively heavy momentary loads nearby

W. M. WINSLOW
Distribution Regulation Engineer
Public Service Co of Colorado, Denver

CIRCUIT BREAKERS are proving to be a desirable alternate for fuses in paralleling single-phase transformers through secondary junctions at point where load current between banks is a minimum. They are valuable where heavy flicker-producing loads are prevalent on the system, their time delay characteristics being more satisfactory for such relatively heavy loads as motor-starting and electric welders.

The result is even better service than is given by secondaries banked through junction fuses at points of minimum load current. Such a fused system has been used with marked success by Public Service Co of Colorado for over 30 yr. Satisfactory operating experience over this period has demonstrated that a secondary junction fuse system is sound and that it gives excellent reliability in serving growing loads.

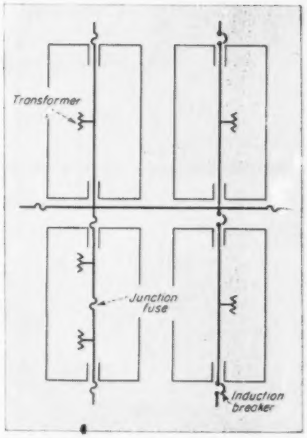
Paralleled operation of distribution transformers through either junction fuses or breakers, as shown, contributes materially to the maintenance of better service continuity, better voltage regulation, and less flicker. If the fuse is ideally located, current through it is zero for a given normal load condition. When a motor starts or other increase in load occurs near the junction, current flows through the junction and the increased load is supplied from two transformers instead of one. Improved voltage regulation thus results from banking by secondary fuse ties, even though the fuses normally carry little current.

Size of fuse is chosen to permit limited operation of a service area from adjacent transformers in case of failure of the serving transformer. Major system disturbances, such as lightning, secondary short circuits and heavy overloads are therefore reflected in fuse failure. Annual inspection and re-fusing has been found adequate to keep a satisfactorily high percentage of fuses in service.

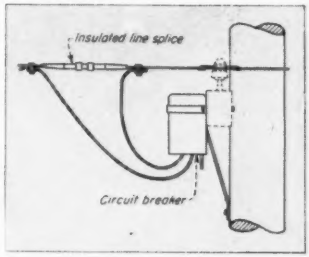
The junction fuse also serves as an operating point on the secondary between transformers. Equipment can be replaced without interrupting service, by coppering adjacent junction fuses before clearing a transformer, for instance, from the line.

Certain operating characteristics are peculiar to this type of banked secondary system. For instance, an open primary conductor between adjacent transformers shifts its load current through the associated junction fuse of the paralleled secondary. In such cases junction fuse failure is paramount to clearing of the faulted primary line.

Also, if secondary junction fuses or breakers are used to bank a single-phase transformer with the corresponding phase of a three-phase delta bank at another location, they should not be placed where they will carry any three-phase load current. In such instances it appears that three-phase loads adjacent to the single-phase transformer must carry three-phase current through the junction fuse or breaker. Actually, three-phase loads supplied through the junctions are not appreciably affected by failure of both junction fuses, showing that the closest single-phase transformer acts as a component part of the three-phase bank intended to serve the load, and thus may be seriously overloaded. This is not the case for three-phase wye-connected banks, which operate the same as paralleled single-phase transformers.



SECONDARY network in which fuses or circuit breakers are installed at points of low current flow, used by Public Service of Colo.



MAGNETIC circuit breaker replaces conventional fuse at junctions for time delay characteristics favorable to heavy starting loads

Junction Fuse Sizes Used By Public Service Co of Colorado

SINGLE-PHASE, THREE-WIRE 120/240 V
THREE-PHASE, FOUR-WIRE 120/240 V

Size of larger of two adjacent transformers	Size of secondary junction fuse
25 kva and smaller	50 amp
37.5 kva	75 amp
50 kva	100 amp
75 kva	150 amp
100 kva	200 amp

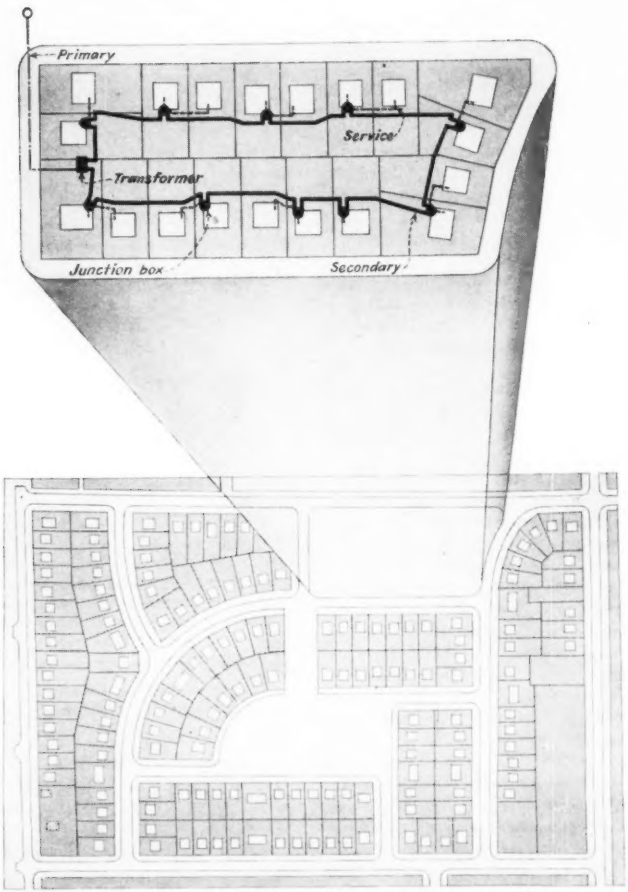
THREE-PHASE, FOUR-WIRE, WYE, 120/208 V

Size of larger of two adjacent banks	Size of secondary junction fuse
3—37.5 kva and smaller	100 amp
3—50 kva and larger	200 amp

Underground Secondary Cable Rings Serve Homes For $130 Each

Canadian utility resorts to novel techniques to evolve unique "bare bones" low-voltage underground distribution system for large residential subdivision

A. L. FURANNA
Engineer
Public Utilities Commission
London, Ontario



BELLWOOD PARK, 32-acre, 186-house residential subdivision in London, Ontario, is proving ground for experimental low-voltage buried cable distribution system. Low-voltage ring, of buried cable (see detail) loops around the rear of each block of 18-20 houses. Junction box in wall of every second house feeds two three-wire services

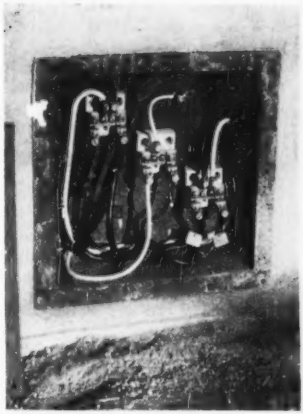
THE UNDERGROUND secondary distribution system that serves the 32-acre Bellwood Park Subdivision at London, Ontario combines unique design with novel construction and new materials while also holding out promise of new maintenance and service techniques. Its high spots are these: (1) Adoption of a low-voltage buried-ring type of distribution to serve houses in each block from the rear, (2) provision of frequent and accessible junctions in the ring make test and sectionalization easy, (3) ring cables are buried in shallow trenches and covered with concrete guards, (4) use of ground-level kiosks to house transformers and their protection, (5) advantage is taken of modern polyvinyl-chloride secondary cable insulation to resist acids, water and alkalies and (6) the system is low in cost averaging an estimated $130 per house or about 25% more than the $105 figure for overhead street-type construction.

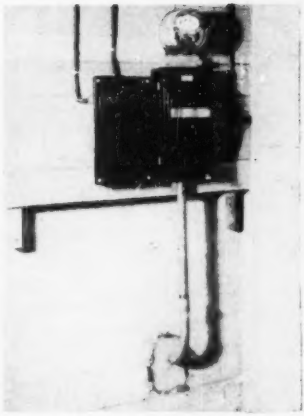
As a proving ground for such a new and untried system, Bellwood Park was virtually ideal. The new 186-house residential development was divided by curving streets into small groups of 18 to 20 houses in a manner that made overhead distribution difficult. Construction was entirely new and to be completed as one project. Since all houses were built for rental, there was but one property owner with whom to deal. There was no existing overhead plant to be abandoned and removed. And finally, the Town Planning Board of the City of London was anxious to develop the project with regard to open spaces, vistas and traffic.

Even early rough estimates showed that the traditional materials for underground use, such as lead-covered cables, wiped joints, ducts and manholes would have to be abandoned in favor of some less expensive construc-

tion that would at the same time, offer reliability.

For secondaries and services, plain polyvinyl chloride covered cable was selected. This material, serving as both insulation and cover, was chosen because tests had shown that its tough texture, resistance to oils, water, acids or alkalis, and its superaging qualities would make it suitable. Moreover, it possessed these qualities to a greater degree than rubber. But since PVC, so-called, is thermoplastic, will soften at elevated temperatures, the cable is designed only for maximum copper temperature of 50 C. However, consultation with cable engineers established that this characteristic would not affect its use in this case. Of the two general types T and TW, the latter was chosen since it produces a more water repellent product.





JUNCTION BOXES in outside cellar wall (left) house three terminal blocks from which services are tapped. Center block is neutral, other two for live leads. Four mains that loop in and out are tagged to make testing and sectionalizing easy. Gasketed boxes are bolted, sealed. Meter installation (right) in house with no junction box. Service enters through sleeve in foundation wall. On inside of wall, conduit rises from sleeve into bottom of switch

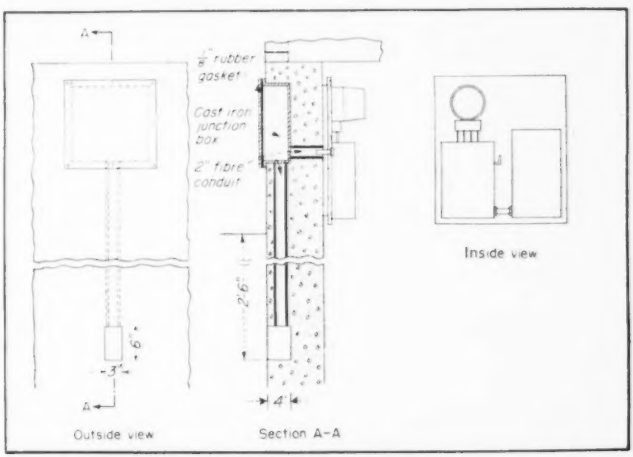
Ring-Type Distribution

General design of the secondary distribution is a ring at the back of the houses in each block. Two No. 2 secondaries loop into a junction box in the basement wall of every second house. Each junction box feeds two No. 6 three-wire services. The No. 2 bare neutral is a solid ring with taps taken into the junctions and services.

This series of junctions in the ring accomplishes two things: (1) It provides convenient test points at frequent intervals for checking the cable insulation periodically and (2) it also establishes easy sectionalizing points in time of trouble. Any one section of cable can be opened without interrupting the circuit.

These junctions are flanged cast iron boxes set in the concrete basement wall by the contractor. Also set in the concrete are two 2-in. fibre conduits. One conduit connects the bottom of the box with an opening in the foundation at the conductor level. The other connects the back of the box with the inside of the basement. A service switch is mounted directly behind the junction box, and uses a short 1-in. conduit nipple to reach into the fibre duct.

There are three spreader blocks in each junction box. These have two 125-amp and two 70-amp. solderless terminals each. The center block is the neutral, and the two outside are for the live leads. Seven wires enter the bottom of the box through the conduit; four main, two service and one neutral conductor. The four mains are marked in pairs with stamped brass tags so that each lead can be identified at any junction point. Two services come off the top of the live blocks, one to the house next door and the other to the house behind the junction box. The neutral tap comes in off the main ring to connect in that home, and the grounding jumper on the side of the junction box.



SERVICE INSTALLATION has junction box and meter panel back-to-back. Short fibre duct and conduit nipple links safety switch and junction. Underground cables enter junction through 2 in. fibre conduit risers from inside of basement and from foundation opening

Secondary and service conductors are laid in the same trench at a depth of 2 ft 6 in. and protected under a common cover. Construction procedure was to open a trench about 12 in. wide as close as practical to the back of the house for a distance of about six houses. The bottom of the trench was then smoothed off to remove any sharp stones or other material which might puncture the cable. Then the cables were laid in the trench and cut to length.

SECONDARY AND SERVICE CABLES are laid in common trench and protected by same concrete cover. Trench is foot wide, $2\frac{1}{2}$ ft deep and very close to backs of houses

CABLE COVERS are 3 ft long, of concrete open at bottom and doweled together at ends to take two steel pins to form chain. In foreground is top where cables run off into house

TAP POINTS where cables run into houses are covered with three-cornered concrete cover. Note unfinished neutral tap ready to be soldered; joints were used only in neutrals

It was then only necessary to straighten out the conductors and lay the covers on top.

Where neutral taps were required into junctions or services, these were left for another crew which made the soldered joints. No joints were used except in the neutrals.

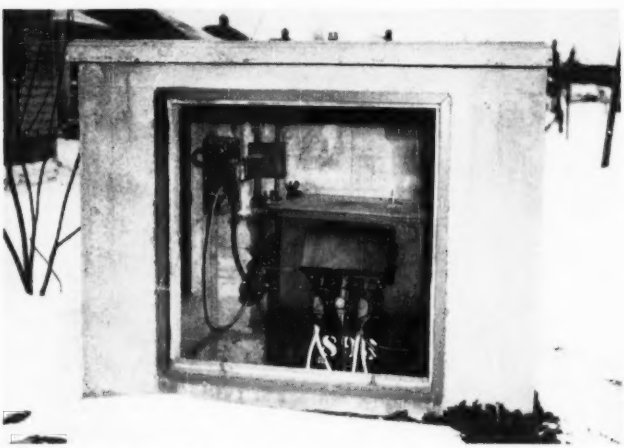
Following this work the electricians installed the spreader blocks and made the cable connections.

Transformers are in vaults located near the rear of the houses. However, they are easily accessible by truck. These transformer vaults are semi-ornamental. Built of precast reinforced concrete, they have three metal doors and stand 3 ft 6 in. above ground. They will accommodate a 25-kva unit with its output and a street lighting relay. Salient features of the design include: (1) A removable concrete top for installation of the transformer, (2) three steel doors designed so that all parts of the transformer are accessible from outside, and (3) protection from tampering is provided by a key lock on the center door. Levers inside that door release the other two.

Cable covers were specially designed for this project. They are concrete, 3 ft long, reinforced longitudinally with two No. 9 wires. Covers are $4\frac{1}{2}$ in. wide with a $1\frac{1}{2}$ in. diameter and semi-circular groove in the bottom. Dowel holes are left in both ends of the cover to take two 6 in. steel pins across the joint between sections. Thus the covers are jointed into a continuous chain. This prevents uneven earth pressure on adjacent covers from shearing off the conductors. At corners where conductors turn off the main route into the services of junctions they are protected by three-cornered concrete covers.

Polyethylene, another thermoplastic, is to be used for the primary conductor insulation. This material has most of the physical characteristics of PVC together with a higher dielectric strength which makes it suitable for 2,300-v service. It will maintain its physical properties up to a critical temperature between 212 and 240 F, well above the maximum operating temperature.

The primary circuit consists of a No. 6 phase wire and a No. 6 bare neutral in 2 in. fibre duct in concrete.



TRANSFORMER VAULTS located near rear of houses are nevertheless easily accessible by truck, and are precast reinforced concrete. They have three doors, removable top, and house up to 25 kva unit with cutout and street light relay. Vault is buried $1\frac{3}{4}$ ft, $3\frac{1}{2}$ ft projecting above ground; front and side dimensions are 4 ft, 1 in. by 3 ft, 3 in.

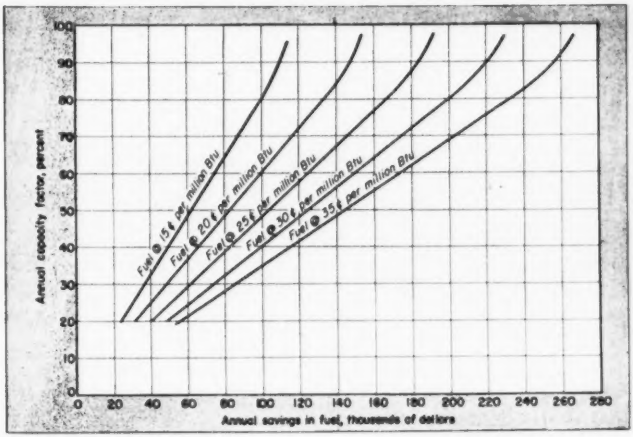

Annual capacity factor, percent
Annual savings in fuel, thousands of dollars
Fuel @ 15¢ per million Btu
Fuel @ 20¢ per million Btu
Fuel @ 25¢ per million Btu
Fuel @ 30¢ per million Btu
Fuel @ 35¢ per million Btu

FIG 1—ANNUAL FUEL SAVINGS from use of 1,250 psi 950 F with 950 F reheat instead of 850 psi 900 F cycle without reheat (80 Mw unit). Assumed capacity factor 65% (see Fig 2)

Union Electric Finds Attractive Return In Reheat

Analysis points to overall return of 10%, with 25% or more accruing to common stockholder. Wage and fuel costs emphasize importance of long-range view

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REPLIES to ELECTRICAL WORLD's survey on the economics of reheat (published September 10, 1949) answer many of the questions raised by the ASME symposium of last December and ELECTRICAL WORLD's editorial of Jan 1 on the subject. The prime question then and still is, "when and why should reheat be applied or how can *you* justify it for *your* plant?"

Faced with the necessity of installing additional capacity, Union Electric Co of Missouri thoroughly reviewed the factors involved to insure attaining optimum overall economy on the new unit. The decision was in favor of a 110,000-kw unit with 125,000-kw capability in conjunction with a single boiler for 1,300 psi, 950 F superheat with reheat to 950 F.

Whether reheat pays is largely dependent on the load factor. A load factor of 60–65% should prevail over the period of amortization. Also the fuel cost must be, and remain, high enough to make the prospective fuel savings favorable, based on the coal prices during the 30-yr amortization period, forgetting present prices.

For equivalent plant heat rates, the reheat cycle is more conservative from the standpoint of availability, than higher temperatures or pressures because lower flue gas temperature is required at the superheater with consequent reduction of maintenance.

The reheat cycle is particularly attractive for large 3,600-rpm units in which the capacity of the largest turbine annulus can appreciably be increased since less steam reaches the last blade row. Further, reduction in auxiliary power gives not only a gain in main-unit net capacity but a chance to supplant kwhr that would otherwise be generated by less efficient equipment.

There is little doubt of attractive return on investment, particularly at the common stockholder's level, over the assumed 30-yr useful life of the unit in the light of the load factors and fuel costs likely to prevail. Upper limit of capacity of the largest 3,600-rpm turbine using 23-in. exhaust blades can be appreciably increased by resort to reheat. There is greater actual send-out for all the structure and auxiliary equipment (including turbine foundation, building, condenser and circulating water structures, coal and ash handling) and the result is an actual decrease in the investment per kilowatt. In the present instance, the estimated cost per kw of rating capacity for the larger (110 Mw) unit with reheat, is not expected to exceed the unit cost of a smaller (80 Mw) unit with a straight regenerative cycle.

If subsequent experience indicates that the predicted load factors were overly optimistic, future capacity additions can consist of non-reheat units of smaller size so as to afford a higher load factor for the present installation in its "sunset years."

Incremental Investment

Preliminary investigation eliminated 1,000 F steam temperature because, higher steam temperatures require higher flue gas temperatures passing over superheater surfaces, and high flue gas temperatures have caused slagging difficulties with the low fusion temperature of the ash in the coals ordinarily available in St. Louis. Long experience with slagging troubles inherent with the coals available, underscored the necessity of avoiding boiler outages from that

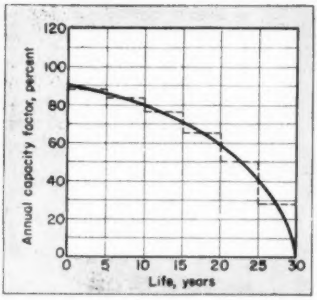


FIG 2—ASSUMED capacity factor is shown from this figure to be 65% during the estimated 30-yr life. However, higher load factors may be expected on more efficient units

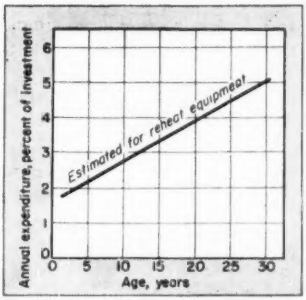


FIG 3—ESTIMATED maintenance outlay for reheat equipment, based on an average of 3⅓% per yr of investment cost over the 30-yr life. Actual figures will probably be lower

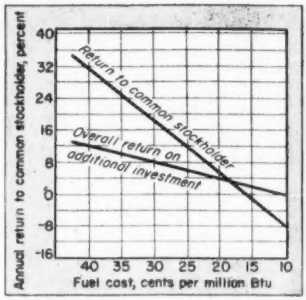


FIG 4—RETURN on additional investment for reheat equipment (1,250 psi, 950/950) compared with non-reheat equipment (850 psi, 900 F), each 65% life capacity factor

source of trouble. Even though the selected steam temperature of 950 F necessitates an average of 1,975 F gas temperature through the slag screen and some 50 F less to the superheater, it was realized that flue gas temperatures through the center of the slag screen would be higher than at the edges, perhaps by as much as several hundred degrees. A 1,975 F average flue gas temperature could easily mean 2,250 F in some parts of the furnace exit zone. With ash fusion temperatures as low as 2,000 F, it is obvious that too high steam and flue gas temperatures would cause trouble. There is no profit in fighting slag for the extra 50 F steam temperature when the gains from the higher steam temperature of 1,000 F could be eliminated by boiler outages; or, high Btu performance means nothing to a plant that is shut down. Putting it another way, the operators and designers should be conscious of the fact that 1% in availability is approximately equivalent to 1% in heat rate. Too few appreciate this important fact: that 3.6 days' outage per year will offset about 100 Btu gain in heat rate.

Another study showed that the incremental cost of 1,450 psi over 1,250 psi was not justified for the conditions set up, and with the prices obtained from boiler and turbine manufacturers at that time.

Three Cases Compared

Therefore, because of these conditions the final comparison focused on the following:

Case A: 850 psi 900 F

Case B: 1,250 psi, 950 F

Case C: 1,250 psi, 950 F, with reheat to 950 F.

In each case a single turbine generator, rated 80,000 kw, 0.8 pf, 100,000 kva, 3 phase, 60 cycles, 13,800 v, hydrogen cooled, and a single boiler were assumed.

The Case A temperature and pressure conditions of 850 psi, 900 F are those of the existing Venice No. 2 Plant. The incremental cost differences for the three cases are summarized and compared in Table I. The left-hand column compares the present Venice No. 2 Plant conditions of 850 psi, 900 F with a 1,250 psi, 950 F non-heat cycle. The middle column compares 1,250 psi, 950 reheat to 950 F with the Venice No. 2 Plant cycle, and the right-hand column compares the 1,250 psi, 950 reheat to 950 F cycle with the 1,250 psi, 950 F non-reheat conditions.

At this time it appears that the 16% additional provision for price increases may not be needed as prices seem to be stabilizing. However, taken with 10% contingencies, the figures are on the conservative side and have reason to be so in view of sad experiences with price increases that have occurred during the past several years. The additional costs, sometimes neglected, bring a factor of safety into the investment cost set-up that was desired by the Union Electric Co management. Then, if the return on the investment is adequate, management will appreciate having the extra cushion that engineering estimates have not always provided in recent years.

TABLE I—Incremental Costs

	Case B costs in Excess of Case A Costs (1,250 psi, 950 F over 850 psi, 900 F)	Case C Costs in Excess of Case A Costs (1,250 psi, 950/950 F over 850 psi, 900 F)	Case C Costs in Excess of Case B Costs (1,250 psi, 950/950 F over 1,250 psi, 950 F)
Estimated field structural costs reflecting prices and wage rates prevailing at time of estimate, and including 10% contingencies	$369,000	$602,000	$233,000
Provision for possible price increases—about 16%*	60,000	98,000	38,000
	$429,000	$700,000	$271,000
Engineering overhead, legal expenses, taxes during construction, administrative costs during construction	46,400	75,300	28,900
Interest during construction	21,000	34,100	13,100
	$496,400	$809,400	$313,000

* At the time this study was made, 15 to 20% price adjustment provisions were a common experience.

Return on the Incremental Investment

Figure 1 shows the annual fuel savings for various annual capacity factors and prices of fuel for Case C compared with Case A. The assumed capacity factor is shown by Fig 2 to be 65% during the estimated 30 yr life. Here again, conservatism is emphasized as higher load factors may be expected on the larger and more efficient units in a large system that

has enough inefficient units for carrying peaks at lower load factor than the system load factor. Many units that are 30 yr old are today operating at fairly high load factors, especially those receiving steam from topping turbines.

In order to show clearly the overall return on the actual investment, Table II was prepared. The return for each case in Table II was developed from a set of fuel saving data similar to the curves in Fig 1.

The savings shown in Table II are also conservative. The only savings included are those in fuel, which are definitely measurable. Other advantages of the reheat cycle, which are not quite as measurable, are:

1. Auxiliary power is less, increasing station kw send-out capacity, hence kwhr send-out per year is larger, giving a gain in supplanting less efficient generation.

2. Dust collectors, fans, bleed heaters, condensor and piping are smaller and lighter weight.

3. Less moisture in turbine exhaust should reduce maintenance of expensive exhaust and blades.

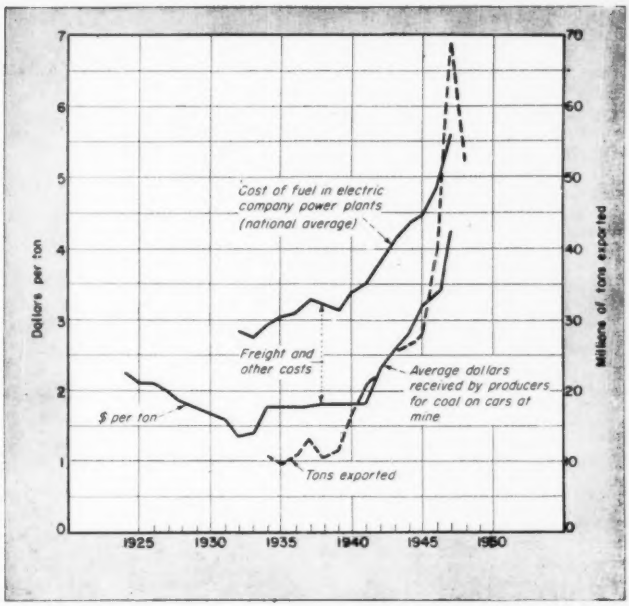


FIG 5—AVERAGE COSTS of coal at mine and delivered to utility power plants

Maintenance was based on an average of 3⅓% per yr of investment cost over the 30 yr life in accordance with Fig 3. This is based on experience with existing plants. It is truly doubtful if maintenance costs as great as those shown would actually be experienced with reheat.

It will be noted that, with fuel at 25¢ per MM Btu, the 6% to 10% return on the total additional investment for reheat is at least equal to the overall return on the property allowed by most regulatory bodies, such as state public utility commissions. Variation of this return for other fuel costs is plotted on Fig 4.

Return to Common Stockholder

The return to the common stockholder follows somewhat the same pattern as the overall return. If the source of funds is assumed to be: 50% from 3% bonds, 20% from 5% preferred stock, 30% from common stock, then Table III shows the return on the incremental investment to the common stockholder with fuel at 25¢ per MM Btu.

In comparing the advantages of reheat (Case C) over Case A, the return to the common stockholder for the estimated 30 yr life is 11.9% which compares with an overall return of 6.1% (Table II). This is a reasonable spread considering the risk involved. An inspection of Fig 4 indicates reheat to be unattractive if fuel cost decreases as low as 20¢ per MM Btu. At that price the overall return is about 4% and the return to the common stockholder is about 5%, both wholly inadequate to justify a project of this nature. On the other hand, increases above 25¢ per MM Btu make return on the incremental investment quite attractive, particularly to the stockholder.

Fuel Cost vs Return

We would normally expect the newest units on the system to have the highest load factors. Since the greatest savings with reheat are realized with high load factors, then the predicted price of fuel, particularly during the earlier life of the

TABLE II—Overall Return on Incremental Investment

	Case B over A 1,250 psi, 950 F over 850 psi, 900 F	Case C over A 1,250 psi, 950/950 F over 850 psi, 900 F	Case C over B 1,250 psi, 950/950 F over 1,250 psi, 950 F
Incremental Investment	$496,400	$809,400	$313,000
Annual Savings			
Fuel Saving @ 25¢ per MM Btu	61,000	135,000	74,000
Offsetting Increases in Operating Costs:			
Maintenance—3 1/3% per yr	−16,530	−26,960	−10,430
Property Taxes—1 1/2% per yr	−7,450	−12,150	−4,700
Depreciation—2.85% per yr	−14,150	−23,070	−8,920
Total Increases	$−38,130	$−62,180	$−24,050
Net Annual Savings Before Income Taxes	$22,870	$72,820	$49,950
Less Federal and State Income Taxes	−5,830	−23,710	−17,880
Estimated Net Annual Savings	$17,040	$49,110	$32,070
Overall Return, Fuel @ 25¢ per MM Btu	3.4%	6.1%	10.2%

FIG 6—PRODUCTIVITY and wage scale of electric utility operating personnel

equipment, is highly significant. Through this period if the price of fuel stays high and a high load factor is maintained, even at the possible expense of another plant, the equipment may pay back most or all of its incremental cost during the first 10 to 15 yr of its life. This may be of particular interest to the common stockholder in determining where to invest his funds. Then, during later years, if the load conditions and fuel costs are such as to produce an unfavorable return on the reheat equipment, the more profitable operations of the earlier years can still make its installation attractive.

There has been little disagreement on the effectiveness of reheat in saving about 5% of fuel costs except that attention should be called to the fact, perhaps forgotten by some, that the reheat cycle gives a higher proportional gain with lower pressures and temperatures than with higher pressures and temperatures.

Perhaps the big disparity in opinion as to whether reheat will pay is the forecasting of future coal costs. Today's coal price has little bearing on the problem, since the prices over the next 30 yr must necessarily be the basis on which today's decisions must be made. Figure 5, which gives coal costs, shows this disparity to have foundation in fact, because coal costs have varied greatly. Growth of the coal miners' union lends weight to the possibility that the coal prices will level out materially higher than in the past. In addition, the number of miners has been very greatly reduced from 491,864 in 1937 to 383,100 in 1945. Competition from gas and oil is not so likely to force coal prices down, as may be expected, because of their own relatively high prices.

Now, no two people can agree on what coal prices will be during the next 33 yr, and it is anybody's right to estimate or speculate on what they will be. At the risk, or rather with the certain knowledge that others will disagree, this slant on future coal prices may have some guide-post value.

Naturally, the best coal veins are worked first leaving the thinner veins, the split veins, the deeper mines, the weak roofs and higher coal costs for posterity.

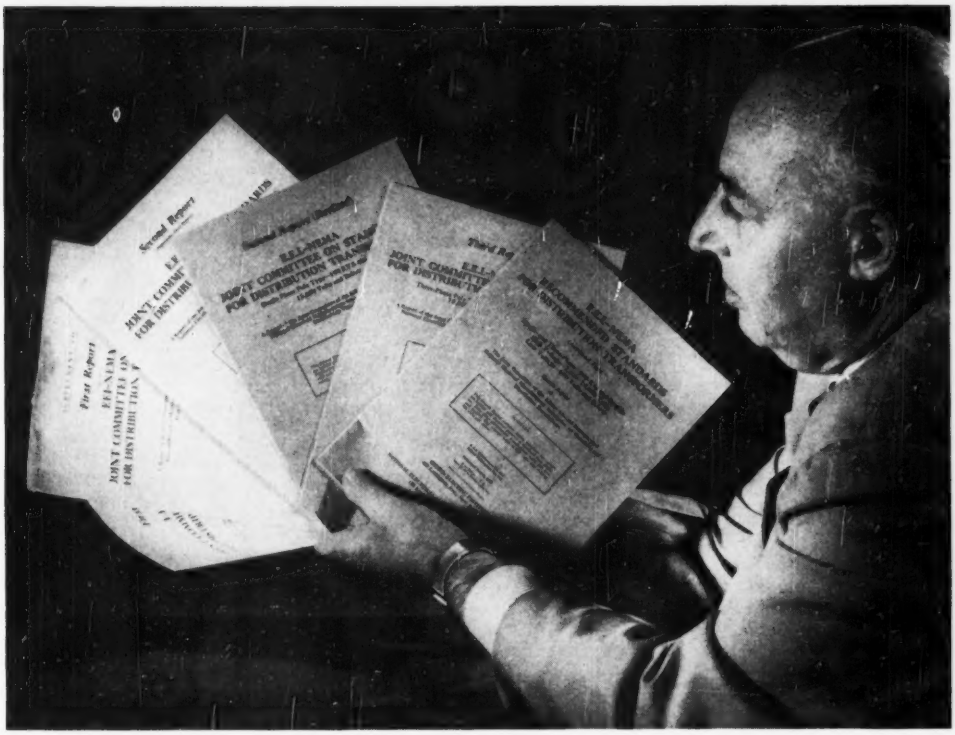
Offsetting the above, the increase of coal mining capacity and increased mechanization tend toward lower coal prices. The Union Electric Co of Missouri believes that after a modest decline, a general leveling off of prices may be expected for the next 10 to 15 yr. Cyclic influences may cause prices to vary from this trend for relatively short intervals, but no substantial price increases or decreases are expected for any sustained period.

TABLE III—Return to Common Stockholder

	Case B over A	Case C over A	Case C over B
	1,250 psi, 950 F over 850 psi, 900 F	1,250 psi, 950/950 F over 850 psi, 900 F	1,250 psi, 950/950 F over 1,250 psi, 950 F
Incremental Investment	$496,400	$809,400	$313,000
Funds obtained as follows:			
3% Bonds 50%	248,200	404,700	156,500
5% Preferred Stock 20%	99,280	161,880	62,600
Common Stock 30%	148,920	242,820	93,900
100%			
Annual Savings			
Fuel @ 25¢ per MM Btu	61,000	135,000	74,000
Offsetting Increases in Operating Costs			
Maintenance— 3 1/3% per yr	−16,530	−26,960	−10,430
Property Taxes— 1 1/2% per yr	− 7,450	−12,150	− 4,700
Depreciation— 2.85% per yr	−14,150	−23,070	− 8,920
	−38,130	−62,180	−24,050
Bond Cost—3% on 50%	− 7,440	−12,140	− 4,700
Total Increases	−45,570	−74,320	−28,750
Net Annual Savings Before Income Taxes	15,430	70,680	45,250
Less Federal and State Income Taxes	− 5,830	−23,710	−17,880
Less Preferred Dividend—5% on 20% of Investment	− 4,960	− 8,090	− 3,130
Estimated Net Saving to Common Stockholder	$4,640	$28,880	$24,240
Return on Common Stockholder, Fuel @ 25¢ per MM Btu	3.1%	11.9%	25.8%

Operating Labor

Figure 6 shows how much the hourly wage of operating labor has increased during the last 50 yr from a cost index 50 to 500 (1914 base = 100). This was made possible largely by increasing the kwhr output per man-year which rose from a low of 100,000 to 1,000,000 kwhr.



WHY IT TAKES FIVE YEARS to achieve an acceptable standard is indicated by the number of drafts exhibited by the author

Constructive Standardization Typified by Transformer Program—II

Over-simplification is as bad a mistake as over-complication. Standardization should stop short of progress-hampering details

H. M. JALONACK
Chairman ASA C-57 Subcommittee on Standards for Distribution and Power Transformers

SIMPLIFICATION makes a good standard; as a general goal it is highly desirable in the interest of economy, but it is a mistake to over-simplify. Standardization often results in simplification but only where simplification has been proved desirable. For example, if the standards specified the removal of mounting lugs from a 50-kva, 2,400-v transformer, this transformer would be simplified to a more basic unit. However for every 50-kva, 2,400-v unit for ground or platform installation that would not require these mounting lugs, there would be 1,000 units where the lugs would be needed. The transformer with lugs therefore should be more acceptable as a standard than the over-simplified unit without the lugs.

In general, practical standards must include all the ratings and accessories usually required in operation. Even where the necessity for certain features is not universally established, it is often preferable and no more expensive to make the stand-

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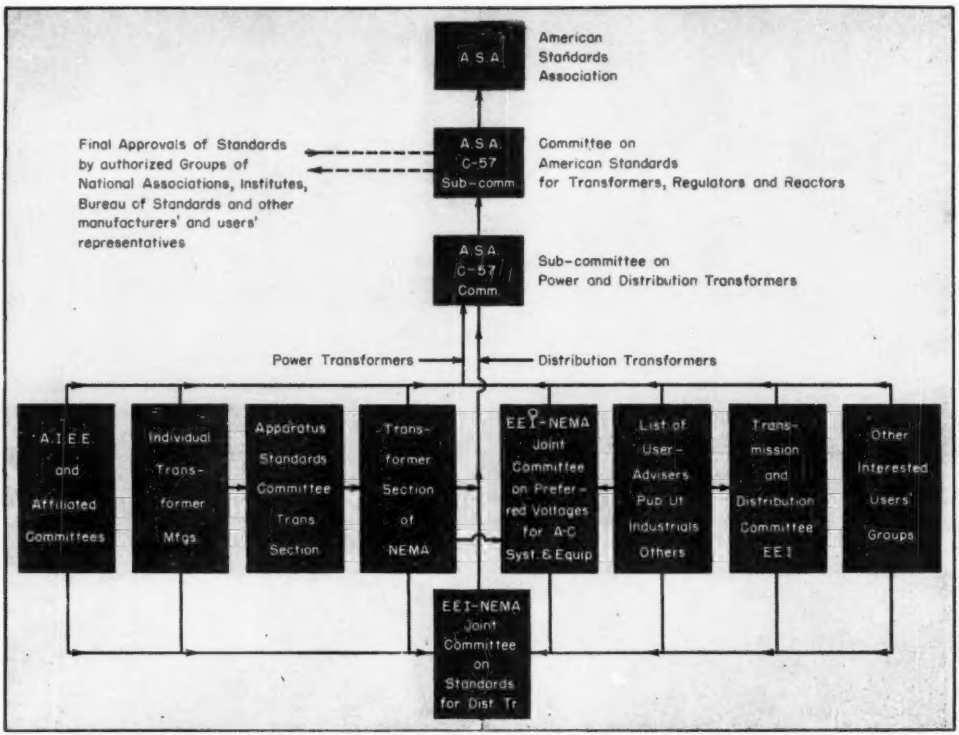

A.S.A.
American Standards Association
Final Approvals of Standards by authorized Groups of National Associations, Institutes, Bureau of Standards and other manufacturers' and users' representatives
A.S.A. C-57 Sub-comm
Committee on American Standards for Transformers, Regulators and Reactors
A.S.A. C-57 Comm.
Sub-committee on Power and Distribution Transformers
Power Transformers
Distribution Transformers
A.I.E.E. and Affiliated Committees
Individual Transformer Mfgs.
Apparatus Standards Committee Trans. Section
Transformer Section of NEMA
EEI-NEMA Joint Committee on Preferred Voltages for A-C Syst. & Equip.
List of User-Advisers Pub. Ut. Industrials Others
Transmission and Distribution Committee EEI
Other Interested Users' Groups
EEI-NEMA Joint Committee on Standards for Dist. Tr.

FIG 1—COORDINATED AND INFORMATION SOURCES in the development of transformer standards

ard units include requirements in general demand and thus obtain a more widely usable standard.

Over-complication Undesirable

On the other hand, when accessories or ratings are required by those who represent a small minority of the users, it is not good standardization to include such items in the standard. Over-simplification is bad —over-complication is just as bad. Assume that on a 10-kva, 2,400-v transformer certain users, definitely in the minority, feel the need of a drain valve and thermometer. Assume, also, that most users see no need for these accessories as regularly-supplied equipment and prefer to obtain transformers on the simpler basis to cover 99% of the installations. Any decision to standardize on these accessories, on all transformers, would certainly be an over-complication, unjustified economically and unfair to the majority.

In some cases a compromise can be effected between the over-simplified and the over-complicated designs. To take a specific example, the standard oil-preservation method on 500-kva transformers is to seal the units completely. Some users feel that such transformers should be equipped with a pressure-vacuum gauge. Other users feel this to be unnecessary. The pressure-vacuum gauge is useful, but not vital. The solution, finally arrived at in the Fourth Report, was to specify a tapped opening of standardized dimensions so that any user desiring a pressure-vacuum gauge could purchase one and mount it in the opening that is provided for this purpose.

Some Standard Features Analyzed

The most important objective of standards, to the user, is to obtain the benefit of lower overall costs. In many cases the standards do lead to lower first cost to the user, particularly if the standard results in a transformer simpler than or as simple as the previous construction. However the user is not generally interested in first cost alone and he may quite rightfully insist on features in the standard which, while adding to the cost of the unit, make an over-all gain factoring operating or maintenance cost.

Most Equitable Specification

In such cases, advice is obtained from a relatively large group of operating and manufacturing experts, whose final weighing of the evidence produces an equitable and usable specification of much broader value than could be produced by individual specification writers. The tabulation shown gives a few of the present standardized features of distribution transformers, and summarizes the reasons underlying the election of this particular feature. Factors governing the final choice are only illustrative, as there were literally hundreds of such decisions made to develop the standards.

How far should standardization go? Can it go too far? The answer is a decided yes. Two major criteria are these: First, does the standard go so far as to restrict progress in the art, handicapping in any way basic new developments in cores, windings, bushings, finishes, etc? Second, does the standard unnecessarily stipulate identical dimensions, mechanical interchangeability or other limits which might delay, discourage or prevent a manufacturer from adopting new and more efficient tools, new and better processes, etc, or confront a manufacturer's engineer with the necessity of innumberable and lengthy conferences whenever dimension changes were indicated by design developments? The following examples illustrate typical analyses of these factors as made by the standardizing committee on distribution transformers.

It proved desirable to standardize, quite accurately, the pole-bolt spacing as this was a valuable feature to users and did not restrict engineering or manufacturing progress. Similarly, the external low-voltage terminals were specified in detail and because

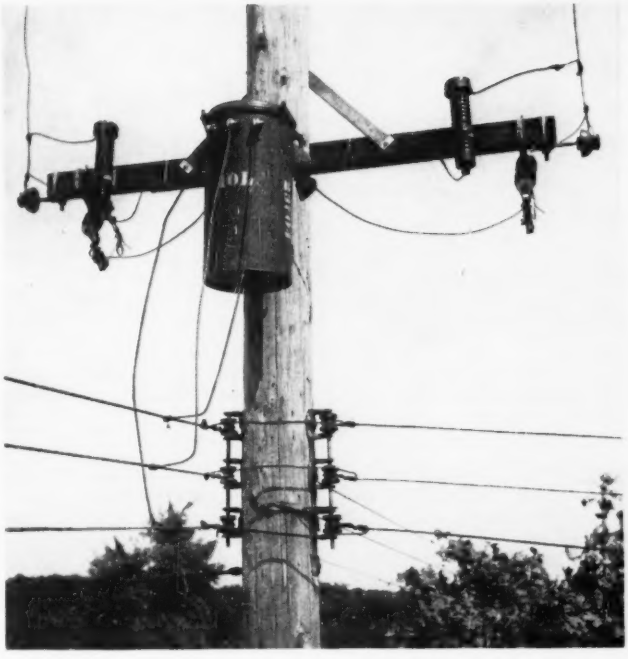


FIG 2—TYPICAL installation of the standardized pole-mounted distribution transformer

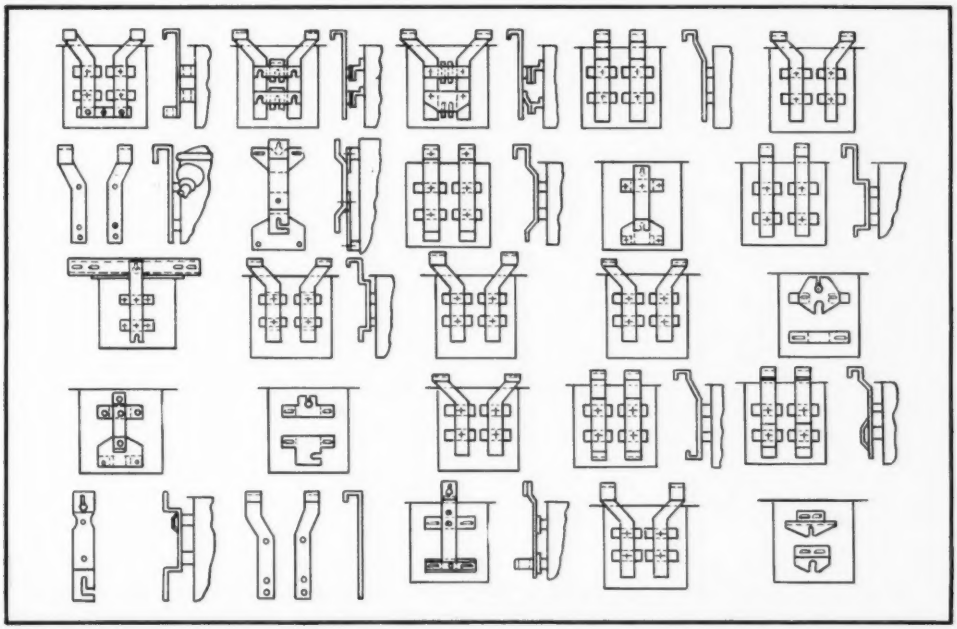


FIG 3—JUST A FEW of the variegated hanger arrangements in vogue before the pole standard mounted transformer was evolved

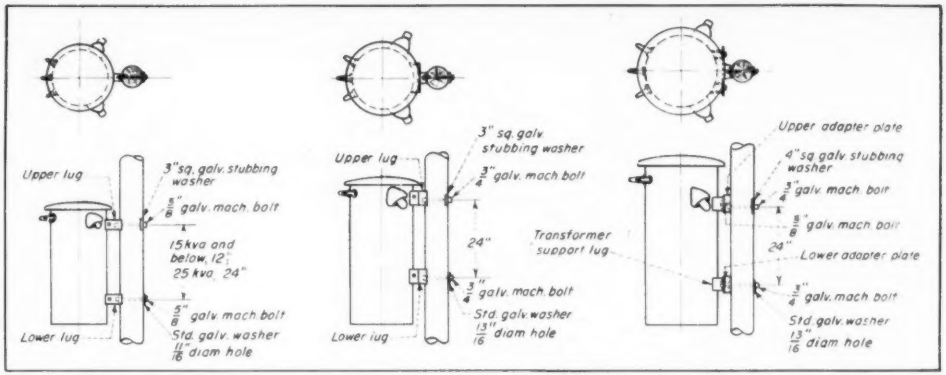


FIG 4—ONE of the participating companies incorporated these typical mounting details in its construction specifications. At left, details for 3 to 25 kva; center, 37½ to 50 kva; right, 75 and 100 kva pole-mounted, single-phase distribution transformers

of the problems of handling heavy low-voltage leads, their dimensional location with respect to a reference plane was accurately specified. On the high-voltage bushing side, however, the dimensions were given considerable tolerance because the smaller primary conductors did not need extreme accuracy in location, if such accuracy had to be obtained at the sacrifice of manufacturing flexibility.

Tap-Changer Handles

Again, while tap changers with handles above the oil level were definitely specified in place of terminal boards, details of the tap-changer construction were not covered in the standard as this might interfere with future progress in the development of tap changers.

Similarly the range of conductor openings on the tank grounding clamps of rural transformers was specified, but not the type of connector itself.

Tank diameter specification on pole-type transformers was avoided, as it is not of vital significance to the user and such a specification would certainly handicap designers. On the other hand, the diameter of submersible units is significant because of manhole opening limitations, and this characteristic is being carefully studied in the development of subway transformer standards.

In the great majority of cases, standard transformers will meet the requirements of the user, since it is this majority that created the standards originally. There are, however, situations where the standards do not apply and cannot be made to apply. An operator with 25, 40, or 50 cycles cannot use 60-cycle standard equipment. A two-phase system can use standard single-phase transformers but it obviously cannot use standard three-phase units. A 3,450-v system cannot use standard 2,400-v, 4,160-v or 4,800-v transformers, although the 3,450-v units can utilize many standardized parts. In such cases, there is no justification for impatience either with the user whose needs are not met by the standard or with those who in developing the standards found existence of insufficient demand to justify creating standards for a scarce or an unusual operating condition.

Standard "Except"

When standard transformers do not fit a particular system, there are two alternatives. The first is to purchase a transformer which fits the system, specifying that all the other characteristics be as nearly in accordance with the standard as possible. This results in the type of unit which is frequently termed "standard except." Such units are of course not standard, and some of the benefits accruing to users of standard units are lost. The more nearly, however, that such units match the standards, the more chances there exist of obtaining part of the benefits. For example, power transformers in the repetitively manufactured class show the maximum cost benefits to the purchaser when standardized voltages and taps are used. However, most of the cost and other benefits, secured with standard transformers, can still be obtained, if the mechanical standards are accepted and if a voltage and tap combination more adaptable to the particular system is selected from an alternate list.

Adapt System to Standard

The second alternative is to fit the system to the standard. This sounds like a large order but it is often the most economical in the long run. Typical examples of such alteration in system, already made or being made are: Changeover from 25 cycles to 60 cycles; changeover from a 9 to 1 to a 10 to 1 system; the application of automatically-controlled feeder voltage regulators or capacitors or combinations of both, to bring systems within the limits of standard transformer tap range. All such situations require a careful review of the problems of system changeover; the anticipated differential between standard and non-standard equipment; the rate of load growth; general industry trends and the accumulative advantages which will accrue in the future to users of standard equipment.

Getting Down to Brass Tacks

Some of the questions seriously asked by several users are:

(a) Will standardization produce the results claimed by its advocates?

(b) Will manufacturing costs really be lower because of this standardization?

(c) Will users share in the benefits of such cost reductions?

(d) Will standardization restrict the user in the development of improved system methods and improved operation?

The basic answers to these questions can be given in reasonably brief form as follows:

Will standardization produce the results claimed by its advocates?

Answer:—Yes, if the standards are well selected and if they are widely adopted by users. Experience with hundreds of different types of established standards have proven that standardization elminates confusion, reduces stocking charges, facilitates interchangeability of equipment, makes engineering time available for system improvements, produces a uniformly higher standard of electrical and mechanical quality and reduces over-all operating costs.

Will manufacturing costs really be lower because of standardization?

Answer:—It has been proven, thousands of times, that larger quantities of identical parts or units can be made at lower costs. Costs are reduced because there are fewer nonmechanized operations and fewer machine set-ups, per unit produced. Machinery and equipment that will produce lower cost components of more uniform quality can be justified only where the quantity of identical items is substantial. Straight-line production, conveyor systems, multiple operations and many other manufacturing cost reduction processes are made possible only by the quantities resulting from standardization. This is the American production system that has surpassed all other methods and has become axiomatic in all modern and progressive manufacturing establishments.

Will users share in the benefits of such cost reduction?

Answer:—Yes. One large manufacturer's figures show that in the last 9 years, core steel has increased in price approximately 70%, copper 96%, porcelain for bushings 50%, labor rates over 60%, freight rates over 55% and other materials used in distribution transformers a similar amount. In the same period it has been necessary to increase distribution transformer prices only 38%. Although the price of distribution transformers, in the case of this particular company, rose, the increase without the present standards, would have been much greater. In fact, without the present degree of standardization, it is doubtful if the peak demand for distribution transformers could have been met in time at any price. The manufacturers would have been simply overwhelmed by the huge variety of types, designs, ratings, and other requirements prevailing in the older, unstandardized days. In a steady material and labor market price reductions would have been made without any question. Perhaps the answer to this question must be taken on faith, a faith founded in the often demonstrated price reductions of the past, whenever and wherever such were possible. There is also present the powerful effect of competition between manufacturers. Thus there exists both the desire and the necessity of transformer manufacturers to pass on savings of standardization to their customers.

Factors Governing the Selection of Some Distribution Transformer Standardized Features

Feature	Alternate Construction Considered	Factors Governing Final Choice	Comments
Cover Bushings on HV side of units above 5,000 v.	Both cover and pocket construction as alternate standards.	Manufacturing costs higher, due to divided production, if both types considered standard. Majority prefer cover.	The fact that in these voltage ratings, a single cover bushing was standard for rural units offered further opportunities for economy.
Pocket or sidewall bushings on HV side of units 5,000 and below.	Both cover and pocket construction as alternate standards.	Manufacturing costs higher, due to divided production, if both types standardized. Majority prefer pocket or sidewall.	
Mounting lugs spaced out from tank.	Mounting lugs closely adjacent to tank.	Close-mounted lugs easier and cheaper to manufacture. Dimensions smaller—crating easier. However, harder to install. Transformer very close to pole means clearances small and no room for leads inside lugs.	Here the convenience of deep lugs from an operating standpoint far outweighed any cost saving of the simpler construction.
Operating handle of tap changer above oil level.	Operating handle below oil level.	Operating handle below oil level, in general, costs less. Tap changer handle above oil more convenient and smaller chance of contaminating the oil.	Convenience and reduced contamination outweighed possible savings due to handle under oil.
Separately mounted LV bushings.	Gang low-voltage bushing in pocket.	Gang bushing in pocket might prove less costly. However, clearance between bushings not too good—better on separate bushings and easier for linemen to make connections.	Separately-mounted bushings offered number of operating advantages more than offsetting possible cost reduction.
Lugs designed for direct pole bolting.	Design lugs for crossarm hanger use only.	Lower cost of lugs if designed only for crossarm hangers. However, proposed lugs gave much less expensive installation when bolted direct, although somewhat more for crossarm hanger mounting.	The opportunity for major savings using direct pole bolting more than offset the higher costs where crossarm hangers are used with these lugs.
7,620-v to 120/240-v tapped units have (2) 2½% taps above and (2) 2½% taps below normal.	(4) 2½% taps all below normal.	The usage of this voltage class is not large enough to justify more than one arrangement of taps on tapped units. This location of taps takes care both of 8,000 v (line to neutral of 13,800-v system) and 7,620-v (line to neutral of 13,200-v system).	There are still a number of 8,000/13,800-Y volt systems. Covering both 7,620 and 8,000-v systems in one rating multiplies the number of similar units made and reduces costs on both groups.
Lighting tap on 3-phase pole-type units.	Omit lighting tap.	Omitting lighting tap would make more economical unit, but cost of supplying small lighting load would be increased.	The additional cost of lighting tap without increasing basic kva of unit was small and presented definite operating advantage.
24 in. between lugs of 25-kva transformer.	12 in. to match 13 kva and smaller and to permit use of smaller crossarm hangers.	12-in. spacing of 25-kva units was placed in production, but tanks had to be made thicker or be reinforced, costing more than the expected interchangeability and smaller crossarm hangers could justify.	Here the final 24-in. standard was evolved after the original 12-in. dimension proved undesirable from manufacturing standpoint.
Provision only for attaching clamp-type terminal to ground transformer tank.	Provide the clamp-type grounding terminal on all units.	Some users ground the tanks. Others are opposed to it.	Provisions for using clamp-type terminal for those desiring it, met needs of both groups of purchasers.

Will standardization restrict the user in the development of improved system methods and operation?

Answer: — Quite the contrary. Standardization on many important mechanical details permits concentration by the user on preferred methods of application, system studies, preferred protective equipment, system power factor, voltage regulation improvement and many other constructive programs. Review of the standards before adoption, by many operators, individually and in national industry committees should eliminate any factors restricting system development. If new problems or new solutions indicate changes in the standards, these should be made not by immediately calling for special construction, but by an orderly review with other users and with the committee sponsoring the standards involved. Standards should not be thrown overboard without a reasonable test of usage but standards must and will recognize progress in electrical distribution and transmission methods.

What kind of standards are best? The best kinds of standards are those created by joint action of the users and the manufacturers. However such standards take much effort to develop and much time as well. Because the necessary decisions cannot be immediately forthcoming, other standards perhaps classed as interim standards must be developed. For example, a transformer manufacturer lacking any industry guidance at all on the spacing of distribution transformer mounting lugs would be compelled to make his own standard. So his manufacturing organization would know what to build. After making the best selection possible, based on his knowledge of design, symmetry and users' practice it would prove a serious burden to be asked for other spacing on these lugs since his drawings, fixtures, shop instructions, etc are based on his own standard. Nevertheless if manufacturer "A" decides on 18 in. and manufacturer "B" decides on 16 in. a user is in a dilemma and must, if he uses both A and B's product, ask one or the other to supply what, to that manufacturer is a non-standard spacing.

The EEI-NEMA Joint Committee, however, which represents both manufacturers and users would produce a much better result, particularly after a really representative list of users has been canvassed. Ordinarily a standard must also pass several important review groups in EEI, in NEMA, and in ASA before a truly American standard is created. Finally wide usage and the test of time eliminate unexpected difficulties and we have a true standard which can last until such time as changing trends or new developments indicate further change.

This explains the apparent duplication where several groups are working on standards for the same transformers. It also explains why, since the developing of standards is a continuing process there is often a time-lag between the different groups on the standardization of a particular item. Thus a manufacturer must proceed on his own standards until NEMA has created a standard and he has had time to manufacture in accordance with it. In the meantime, the EEI-NEMA or other Joint Committee is reviewing the individual manufacturers' standards or NEMA standards as the basis for either confirming those standards or suggesting alterations. Other interested bodies have developed facts and proposals. An American Standard is finally approved by the ASA C-57 Sectional Committee. Groups most intimately connected with the development of standards for power and distribution transformers are shown in the chart. The chart shows how the work of these various groups is related in the development of American National Standards.

Use is What Counts

The author hopes he has conveyed some of the background behind the standardization of transformers. The sponsorship of such standardization is shared by top utility management who feel the vital necessity of promoting all projects leading to reduced costs and improved efficiency on their systems. The development of standards is hard work and the committee members deserve great credit for their interest and enthusiasm which has remained undampened by the consideration of literally thousands of small but important details. These committeemen ask no reward for their services other than the confidence of the users and the manufacturers in the beneficial results of standardization. This means for the manufacturer a determination to pass on to the user, as rapidly as possible, gains resulting from the standardization. It means for the user the acceptance and use wherever possible of the standard.

Without widespread use, there can be no gains and without gains the committee has wasted its time. With widespread use of the standards, their efforts and the time and expense of their sponsoring companies will have been well repaid.

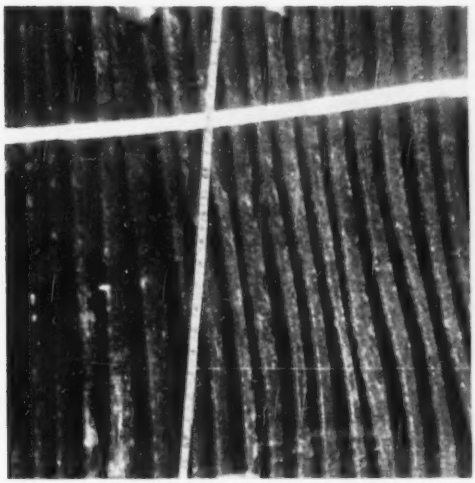
Simple Artifices Cut Cost of Operation

SMALL SIGNS for panels, etc, are engraved by Toledo Edison Co on a laminated plastic. These are found to be much cheaper than porcelain signs. One man can setup and make 25-50 small signs per day. There is also the advantage of being able to make signs which cannot be made from porcelain.

The transformer department has constructed two coil-winding machines from miscellaneous parts. The clutch arrangement was taken from an old type Overland car, and old boiler stoker gears were used for the gearing. The rest of the machine was built from scrap.

Experience has shown that it is not necessary to use ducts when laying cable from substations to lateral poles and from one substation to another in outlying districts. Neoprene or jute covered cable is buried at a depth of 3 ft in sifted earth and protected by creosoted planks. Also, signs are placed along the cable line to give warning of high voltage.

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN



UNDERWATER PHOTO taken with synchronized neon flash shows (upper center) damaged intake rack 25 ft below surface. Photo technique permits hydro maintenance without loss of plant operation

CRACK IN DAM was located through use of photo showing dam and buttress wall 30 ft below surface. Underwater photographs facilitate maintenance on dams which do not have provisions for unwatering

Underwater Photography Aids Maintenance

WALTER BRENTON
Supt of Production
Portland General Electric Co,
Portland, Ore.

UNDERWATER PHOTOGRAPHY can assist in making substantial savings in plant maintenance costs. Exact information as to the condition of submerged facilities may save a preliminary shutdown for inspection, make possible assembly of the necessary materials, and even make final repairs possible without loss of plant operation.

Beavers Cause Shutdowns

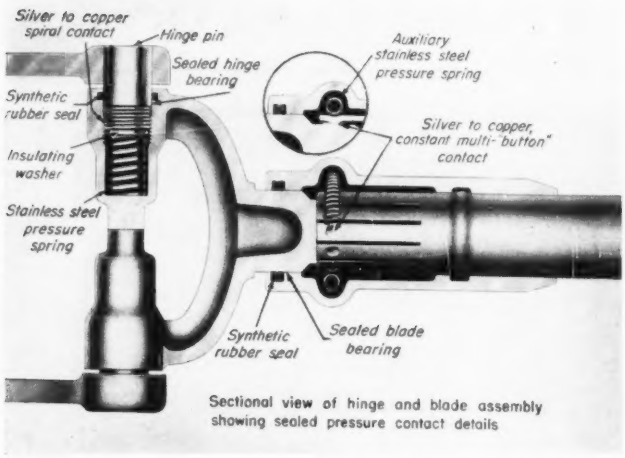
At one of the hydro plants of the Portland General Electric Co. sticks cut by beavers had caused shutdowns on several machines. Complete inspection of racks at the head of the penstocks would have required draining the forebay with resulting loss of generation, so an underwater photographic inspection of the racks was made. The illustration on the left, taken under about 25 ft of water, shows one point of trouble. Exact location and dimensions are readily obtainable from the picture by reference to the steel tape and the rule placed on the racks by the diver prior to taking the pictures. A new section of racks was constructed and the old section replaced with the plant in operation except for the unit involved. The defective section was then repaired and used for replacement of the next section requiring attention.

Another example of the use of underwater photography, illustrated on the right, shows the upstream face of a small concrete arch dam where it joins the buttress. This picture was taken under about 30 ft of water. Leakage through the dam had reached an appreciable amount at certain points. The dam was constructed without provisions for unwatering, so an underwater photographic survey of the upstream face was made. Study of the pictures indicated that the probable source of the leakage was confined to sections of certain construction joints. These joints were cleaned out by the diver, calked with tarred oakum, and then covered with an underwater calking compound. This treatment is satisfactory from the standpoint of stopping the leakage until an opportunity permits a more permanent job of pressure grouting to be undertaken.

Take 40 Pictures Each Dive

Both pictures were taken by the diver on 35-mm film with the aid of a neon flash synchronized with the samera shutter. Forty pictures can be taken on each dive. This type of photography would probably be limited to use where the water was comparatively clear. Harold Maiken, manager of Commercial Divers, Inc, Portland, Ore., developed the underwater photographic equipment used on these jobs and took the pictures appearing on this page.

Hinge Contact Eliminates Flexible Shunt From Switch


Silver to copper spiral contact
Hinge pin
Sealed hinge bearing
Auxiliary stainless steel pressure spring
Synthetic rubber seal
Silver to copper, constant multi-"button" contact
Insulating washer
Stainless steel pressure spring
Synthetic rubber seal
Sealed blade bearing
Sectional view of hinge and blade assembly showing sealed pressure contact details

SECTIONAL VIEW of high-pressure sealed hinge contact assembly on a type TTR-49, 34.5-kv, 600-amp air disconnect switch. Shown are blade rotating constant contact and blade hinge constant contact to switch frame. Insulating washer acts as spring bearing plate

By THE DESIGN of a pressurized sealed contact, the hinge of an air break disconnect switch becomes part of the device's conducting circuit for line current. Adoption of the sealed pressure hinge contact eliminates the flexible connector or shunt at the hinge end of the blade. It also makes possible the use of only one exposed dual make-and-break contact for line current. The development is found in the type TTR-49 switch produced by Railway & Industrial Engineering Co. Greensburg, Pa.

Enclosed end of the tubular copper blade is slotted or "tulip" shaped. Copper button contacts on the inside diameter of each lip have been formed by partial pressure of a punch die. These buttons are in contact with a silver inlay on the bronze hinge spindle. This contact assembly has an auxiliary non-magnetic, stainless steel spring to supply further pressure followup on the button contacts than is provided by the hard drawn copper tube alone. This assembly is sealed in the blade end by a synthetic rubber ring, sealing in the inhibiting grease and sealing out weather and corrosion.

The hinge casting has two high-pressure contacts, one on each side which transmit the current from the blade hinge casting to both sides of the tie casting. These contacts each consist of a silvered hard-drawn copper hinge stud which is held against a helical contact in the hinge casting, against the pressure of a non-magnetic stainless steel spring. This spring pressure loads the spiral contact area with pressure and the result is a current-carrying joint similar in principle to the annular sealed hinge in the company's type HPS disconnect switches. The spring, and the helical stud are coated with inhibiting medium, a surplus of which practically fills the spring cavity. An insulating washer acts as a spring bearing plate and insulates the spring from the copper hinge stud.

The hinge stud is locked to the frame by an internally expanding Morse taper head, stainless cap screw.

In the design of the make-and-break contacts for line current, the stationary contacts are a cold rolled hardened silver inlay brazed to forged copper backing fingers. Beryllium cobalt copper springs are used to carry the current to the contacts and supply the necessary spring strength and resiliency. In addition, without lowering the unit pressure each jaw contact finger was divided in half, or split, to furnish additional contact and heat storage capacity for short-circuit conditions. The tubular switch blade is hard drawn copper with a solid-copper backing forged into a blade contact. Contacts of all switches have been life tested and overload tested beyond their required short-circuit ratings to be sure of adequate margins for all required conditions.

The TTR-49 utilizes the same general operating principles as the original TTR switch has had for many years. The redesign and simplification has reduced the number of parts in a standard assembly from 47 to 27.

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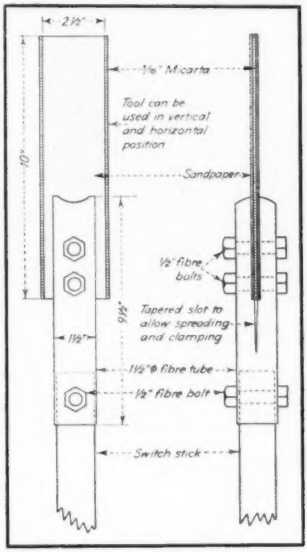


TOOL for sandpapering blades and clips

Cleaning Switch Blades

M. A. SAREAULT
Supt of Substation Maintenance
Narragansett Electric Co.,
Providence, R. I.

An EASILY constructed tool for cleaning switch blades and clips while alive or dead is shown here. It can be used both vertically and horizontally. Essentially it consists of a sandpaper strip 2½ in. wide x 10 in. long held in place by $\frac{3}{16}$ in. of micarta and clamped into split fiber tube by two ½-in. fiber bolts. The 1½ in. diam tube is secured to the head of a standard treated switch stick by a ½-in. fiber bolt as shown in the drawing above.

1949 cost reductions changed capacitor economics

It will pay you to re-evaluate

The price of 25-kvar capacitor units was cut 20 to 23% in 1949! These reductions on 25-kvar units and on capacitor equipments mean that you can now supply your system kilovars at a lower cost than ever before in history.

These new low prices dictate a re-evaluation of capacitor economics. Proposed installations which were considered marginal less than a year ago are now economically justified. Additional installations never before considered, may now be practical.

Your G-E sales representative will be glad to help you determine the up-to-date capacitor economics of your system. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

G-E Pyranol® capacitors, including the 25-kvar pole mounted unit shown here, can be shipped from stock. Installation is simple and quick—they can be in service, releasing kilowatt capacity and improving voltage level, in a matter of weeks.

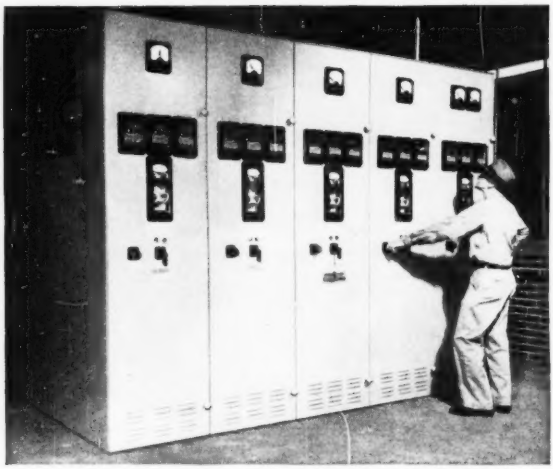
A G-E capacitor is one of the most reliable pieces of electrical equipment you can install. The glass bushings are welded to the drawn steel container for a permanent hermetic seal. The use of low-loss Kraft paper impregnated with Pyranol assures stable characteristics throughout a long operating life. In every respect, G-E capacitors are a proved product—proved through field experience measured not in years, but in decades.

GENERAL ELECTRIC

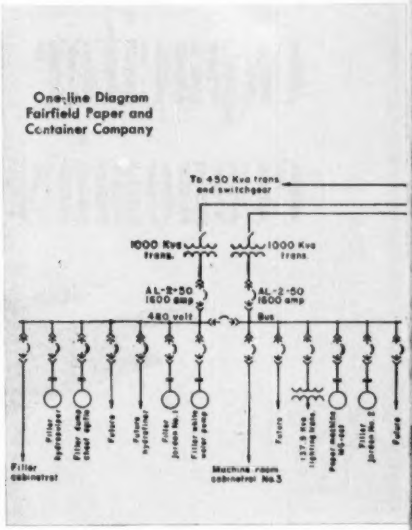
417-21

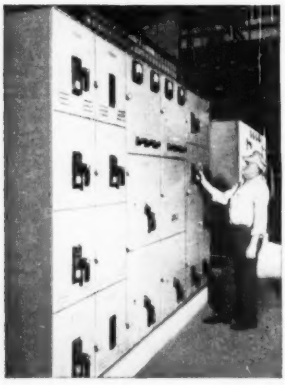
FAIRFIELD
PAPER AND CONTAINER CO. chooses a

METAL-CLAD
for



General Electric 5-kv Type MI-6 metal-clad switchgear consisting of one incoming-line breaker and four feeder breakers to handle 4160 volts at Fairfield Paper and Container Co. Magne-blast air circuit breakers are rated 1200 amperes, 100,000 kva interrupting rating. Note neat appearance of metal-clad unit. It's space saving too, and the metal-clad construction offers operating safety to personnel. Units like this are easily installed and can be added to with a minimum of bother and expense. Instruments and relays are co-ordinated for positive protection of circuits.

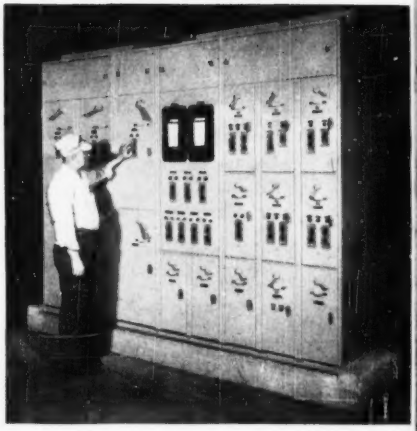




G-E Cabinetrol units provide centralized control for the liner stock system. Unit controls motors, valves, agitators, etc. Ammeters record load carried by hydrapulper and hydrofiner. Four other Cabinetrol units are used throughout the mill.

The Fairfield installation is a complete General Electric project—one source of responsibility plus the very best in co-ordinated planning, engineering, manufacturing, and servicing facilities to give maximum savings and efficiency to the customer.

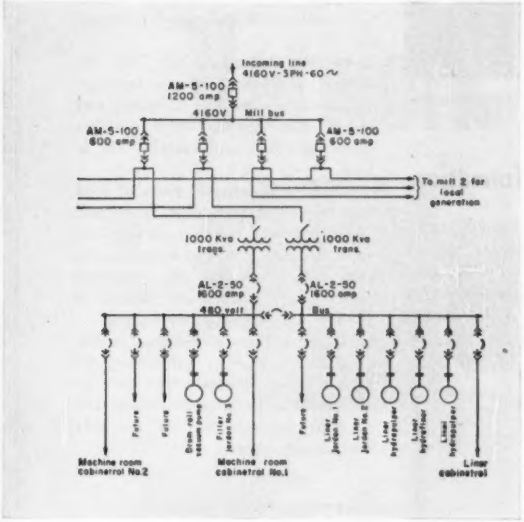
Two G-E low-voltage metal-enclosed switchgear equipments take the 480-volt power from the 1000-kva transformers and distribute it to motors, lighting transformers, and five Cabinetrol units. The Type AL-2 transformer secondary breakers and tie breakers are rated 1600 amperes, 50,000 amperes interrupting rating. Type AK-1 drawout air circuit breakers of 25,000 ampere interrupting rating are used to feed motors and Cabinetrol. Breakers for future circuits can be installed in spare compartments. G-E air circuit breakers have adequate "IC" (Interrupting Capacity) for short circuit protection, are easily removed for inspection.



secondary-selective system using

SWITCHGEAR

continuity of service



At the new Fairfield Paper and Container Co. installation General Electric metal-clad switchgear receives the incoming 4160-volt power and distributes it to 4-1000 kva transformers for step-down to 480 volts. G-E metal-enclosed switchgear handles the 480-volt power through air circuit breakers of the drawout type. In general, all motors rated 60 hp and above are served by an individual breaker. Five Cabinetrol units are fed by air circuit breakers. Note that costly secondary feeders are short.

This secondary-selective system is only slightly higher in cost than a simple radial system, and provides Fairfield insurance against a complete shutdown in case of failure of any one transformer or its primary feeder cable. If trouble occurs the normally-open tie breaker is closed, thus providing an alternate source of power which permits the mill to operate at slightly reduced capacity.

Be sure to see the "More Power to America" full-color sound slidefilm "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.

here's why...

"When we planned our new facilities it was decided that a secondary-selective power distribution system would assure us of the continuous power, even in case of a major fault, needed for continuous-process operations like ours. We ordered G-E switchgear because their "metal-clad" protection safeguarded our employees, and because we could get all engineering, equipment and service from one organization. By dealing with one company we saved considerable time and money. The units arrived complete and we installed them in very little time."

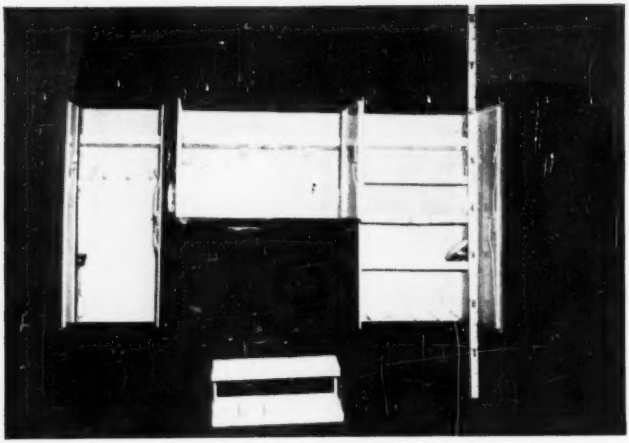
H. L. CUSTER, VICE PRESIDENT AND GENERAL MANAGER, THE FAIRFIELD PAPER AND CONTAINER CO., BALTIMORE, OHIO

MODERN INDUSTRIAL **power distribution systems using G-E switchgear are applicable to any industrial plant or commercial building where you want proper voltage for top performance of equipment, an extremely flexible setup to take care of expanding or changing loads, adequate short circuit protection, safety to personnel, and low installation and maintenance costs. A complete system, using G-E switchgear, costs you less than a "piece-meal," makeshift affair.**

INVESTIGATE TODAY **the many advantages of using General Electric switchgear in *your* plant for efficient, flexible power distribution. Contact your G-E sales representative for further information—or write for the helpful bulletins listed below. *Apparatus Department, General Electric Co., Schenectady 5, New York.***

GEA-3083	Metal-clad Switchgear
GEA-4966	Low-voltage Metal-enclosed Switchgear
GEA-3592	Load-center Unit Substations
GEA-3758	Load-center Power Distribution
GEA-4057	Interlocked-armor Cable for Primary Circuits
GEA-4352	Flamenol Cable for Secondary Circuits

GENERAL ELECTRIC



CABINET SPACE on line truck is better described, including sizes of compartments, with picture than with drawing. Method saves making detailed measurements and drawings

Photograph and Rulers Give Necessary Information

When Dallas Power and Light Co received numerous requests for information about different pieces of equipment the method shown in the photo was developed for giving details and measurements. By placing rulers beside the equipment and taking a picture, all desired information could be passed on without resorting to detailed drawings and descriptions.

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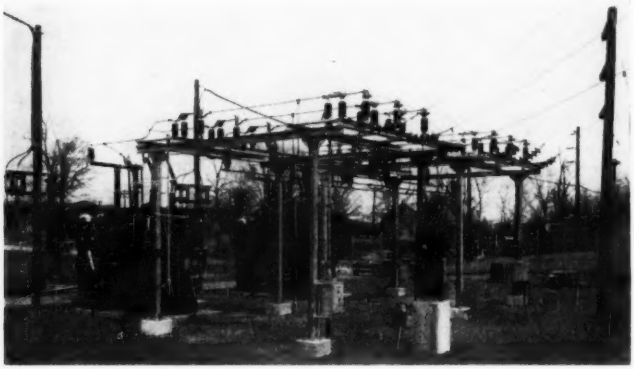


STEEL STRUCTURE in each unit-substation bay consists of two "A" unit assemblies placed 16 ft apart and joined by two horizontal members to form an assembly "B"

Substation Structure Composed of Unit Assemblies

A substation steel structure used to mount high-tension bus equipment is now made of two or more basic assemblies according to the number of unit substations to be served. Economies have been realized along the line from design, through erection, expansion and ultimately in salvage. This type of construction is used by an eastern utility.

Each basic assembly is a unit structure consisting of a box frame mounted on two columns, all members being 6-in. H-beams. The unit structure is designated as assembly "A" and terminates a line and mounts a horizontal gang-operated disconnect switch.

If a full bay of steel is required to accommodate line and transformer disconnecting switches and a high tension bus, two such assembly "A" units are placed 16 ft apart and tied together by two horizontal members. Such structure is designated as assembly "B".

Additional members have been designed to provide phasing facilities with underground line entrances and bus section disconnection switches when more than one assembly "B" is used.

The total number of types of steel members involved is nine. If desired, they can be ordered in quantities and kept in stock. When a substation structure is needed, the required number of members are ordered to the job and assembled by bolting.

Should it become necessary to discontinue or move a substation, the high tension structure can be disassembled and re-used elsewhere. The concrete footings will be the only item unsalvageable.

Average Mileage and Costs Cut Paper Work

W. L. RUSH
Louisiana Power & Light Co, New Orleans, La.

Electric power extensions are now authorized by *single* work authorization sheets which use average mileage and customer costs based on past construction experience. Detailed material and labor estimates, previously added to these sheets, are no longer required.

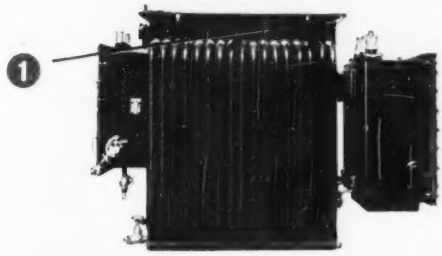
This single sheet gives miles of line to be built number, of customers to be served on each extension and applicable rate schedule. Also noted on the sheet are estimates of cost and added revenue. It eliminates much time and paper work and it has been found that figures average out very well. A separate sketch is used to show the location of each proposed extension.

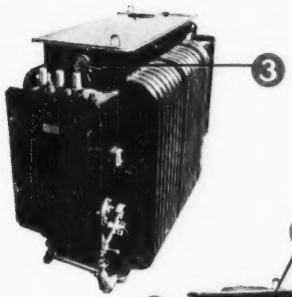
The a-c secondary network system is now recognized as *the* lowest-cost system for providing high-quality service to heavy load areas. While normally used for business sections of cities—50,000 or more in population—it will frequently pay its way in smaller towns as well.

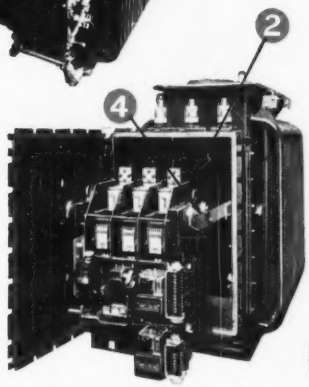
But—to realize the full savings possible with networks, you must use standardized network equipment. For example:

YOU SAVE ON MAINTENANCE when you specify

Standardized Network Equipment







1 MAJOR GASKETS ARE ELIMINATED by welding, not bolting, transformer cover and switchbox to the main unit. Locating the tap changer behind a pipe plug eliminates a packing gland around an external shaft.

2 BUSHINGS can be removed externally, without opening the main transformer tank.

3 ALL TRANSFORMER ACCESSORIES—liquid-level gages, thermometer, tap changer, and all valves—are located at the high-voltage end of the transformer, easy to get to and check.

4 NETWORK PROTECTOR can be slid out on rails for quick inspection. Relays plug in—can be easily removed and replaced for checking.

PLUS **FASTER DELIVERY**— G-E standardized network transformers and protectors can be supplied on shorter delivery.

LOWER PRICE— G-E standardized network units are appreciably lower in price than non-standard designs.

LOWER INSTALLATION COSTS—G-E standardized network units are designed for narrower, shallower vaults, saving substantially in vault-construction costs.

Ask your G-E representative or write to Apparatus Dept., General Electric Company, Schenectady 5, N. Y. for full information on standardized network equipment. Bulletin GEA-5024 describes network transformers; GEA-2017, network protectors.

INCREASED Interrupting Ratings on Network Protectors

Type	Continuous Rating in Amperes	Interrupting Rating in Max. R.M.S. Amperes
MG-13	200 to 600	20,000
MG-8 or MG-9	800, 1200, 1600 2000 2500 and 3000	30,000 35,000 60,000

GENERAL ELECTRIC

4102-77

Types and Characteristics Of Portable Fire Extinguishers

Eight types of first-aid fire extinguishers are listed for three classes of fires, and operating characteristics are outlined for standard portable units. Data compiled by Insurance Department, Consolidated Edison Co of New York, Inc, for training employees

Table I—Type of Extinguisher Most Effective on Each Class of Fire

Type	Anti-Freeze	Soda-Acid	Foam	Vaporizing Liquid	Carbon Dioxide	Dry Powder	Mobile Unit
Class A Fire (Wood Rubbish, etc.)	Yes	Yes	Yes, less effective than soda-acid	No	No	No	No
Class B Fire (Oil, Grease, Flammable Liquids, etc.)	No	No	Yes	Yes, on shallow oil fires	Yes, most effective on confined oil fires	Yes	Yes
Class C Fire (Electrical Equipment)	No, Dangerous	No, Dangerous	No, Dangerous	Yes	Yes	Yes	Yes

Table II—Standard Portable Fire Extinguishers

TYPE	NON-FREEZE (for temperatures as low as −10F)			SODA-ACID		FOAM		VAPORIZING LIQUID		CARBON DIOXIDE	DRY POWDER	MOBILE UNIT
Chemicals Employed	Sulphuric Acid, Potassium Carbonate, Calcium Chloride	Fuse Cartridge, Calcium Chloride	Carbonic Acid Gas Cartridge, Calcium Chloride	Bicarbonate of Soda, Sulphuric Acid		Bicarbonate of Soda, Foaming Agent and Aluminum Sulphate		Carbon Tetrachloride with Important Components for Depressing The Freezing Point, Avoiding Corrosion, etc.		Liquefied Carbonic Acid Gas	Bicarbonate of Soda, Free Flowing Agent, (Liquefied Carbonic Acid Gas Cartridge)	Nitrogen, Water
Rated Capacity	2½ gal			2½ gal	40 gal	2½ gal	40 gal	1 qt	1 gal & 3½ gal	10–77 lb	15 lb	20 gal
Method of Operating	Invert	Invert and Bump		Invert	Tip Down	Invert	Open Valve and Tip Down	Pump	Opening of Valve	Opening of Valve	Opening of Valve	Opening of Valves
Method By Which Pressure is Created	Chemical Reaction	Burning of Fuse	Release of Stored CO_2	Chemical Reaction		Chemical Reaction		Hand Pumping	Release of Stored Air Pressure	Release of Stored CO_2	Release of Stored CO_2	Release of Stored Nitrogen
Effective Range of Stream	30–40 ft			30–40 ft	50–60 ft	30–40 ft	50–60 ft	20 ft	30 ft	6–8 ft	20 ft	6-ft diam spray
Quantity of Principal Extinguishing Agent Produced	2½ gal			2½ gal	33 gal	20 gal	300 gal	Variable—Depends Upon Amount of Liquid Which Comes in Contact With Heat of Fire		9 cu ft per lb of gas	15 lb	20 gal
Nature of Principal Extinguishing Agent	Calcium Chloride Solution			Soda Solution		Fire Foam—A Mass of Bubbles Filled With Carbon Dioxide Gas		Free Gas Produced When Liquid is Vaporized by Heat of Fire		Free Gas	Dry Powder	Water Spray
Principal Extinguishing Effect	Cooling Quenching			Cooling Quenching		Blanketing and Cooling		Blanketing		Blanketing	Blanketing	Cooling Blanketing
Caution	Do not use on live electrical equipment			Do not use on live electrical equipment, protect against freezing				Not to be used in confined places without gas mask protection; use fire extinguishing liquid only for recharging		.....	.....	Attach ground clamp when used at electrical locations

Still time to win your share of
$21,000 IN CASH PRIZES!

PRIZES FOR INDUSTRIAL, COMMERCIAL, AND HOME LIGHTING!

PRIZES FOR UTILITY, WHOLESALE AND FIXTURE SALESMEN; ARCHITECTS; CONTRACTORS; RETAILERS; BUILDERS; CONSULTANTS!

Select your entries now for General Electric's big Planned Lighting Contest!

YOU'RE eligible for as much as $250 in cash prizes if you've helped with a Planned Lighting job using General Electric lamps in 1949!

Awards will be made on 36 commercial, industrial and residential installations; and each award carries several $100 prizes for those helping to plan, sell, supply and install the lighting—192 cash prizes in all! In addition, the person sending in the report on the winning job receives an *extra* $150. Winners will be chosen from cities in three population classes; and judging will be based on how well the installation did the desired job for the user.

All entries must be in the mail no later than January 31, 1950, so get yours ready right away. If you don't already have the rules for G.E.'s Planned Lighting Awards, call your local General Electric Lamp Department office.

You can put your confidence in—

GENERAL ELECTRIC

NOW...Moloney

REVOLUTIONARY PRINCIPLE OF REACTOR SWITCHING

An entirely new and revolutionary principle of reactor switching is used in the Moloney Load Tap Changers. Through its use, there is no Switching Reactor (Preventive Auto) loss on half of the operating positions when operating half cycling, and no loss on *any* operating position when operating full cycling. Diagram shows how reactor halves are by-passed when Tap Selector Switch is in any "on contact" position. Elimination of reactor loss results in tangible savings in operating costs.

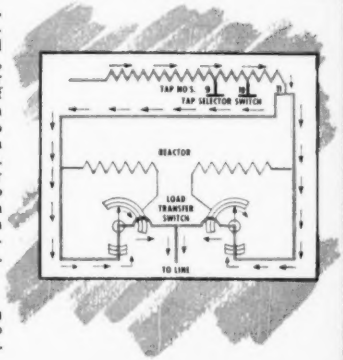


Diagram shows how Switching Reactor is by-passed to eliminate its loss.

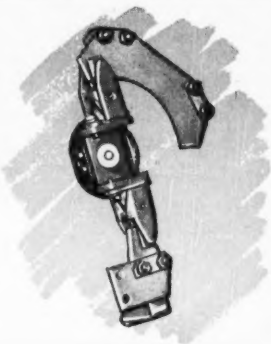
NO ARCING ON TAP SELECTOR SWITCH

The Tap Selector Switch on Moloney Load Tap Changers does not have to perform the dual function of breaking current and changing taps. A separate Load Transfer Switch makes and breaks the circuit, eliminating all arcing duty from the Tap Selector Switch, and making it possible to use longer arc clearances and highly accelerated breaker opening and closing speeds, with consequent increase in interrupting capacity.

Load Transfer Switch at upper left. Reversing Switch at upper right. Tap Selector Switch at bottom.

COMBINED SPRING-ACCELERATED AND DIRECT DRIVE LOAD SWITCHING

Highly accelerated opening and closing speeds are used on the Load Transfer Switches to minimize arc erosion. These high speeds are obtained through the use of accelerating springs. Although the spring materials used and stresses at which they are operated are such that almost indefinite life is assured, in event of spring failure, the tap changer will continue to operate in direct drive. This system combines the best features of spring drives and direct drives.



Load Transfer Switch, right, is driven by accelerating spring arrangement to provide highly accelerated opening and closing speeds.

Load Tap Changer!

DESIGN CHARACTERISTICS AND RATING

Moloney Load Tap Changers are designed to operate satisfactorily under the following operating contingencies:

1. Continuous full-load operation at any point in its operating cycle

2. Short circuits or grounds on systems to which it may be connected where the current may reach 25 times normal rating for 2 seconds

3. Recurrent short-time overloads or emergency short-time overloads as defined in the American Standards Association Guide for Operation of Transformers and Regulators, *making it possible to take full advantage of the full transformer capacity following partially loaded conditions or during times of low ambient temperature*

4. Reduction of control voltage up to 25% with sufficient torque for tap changer operation still developed by driving motor

5. Impulse, surge or transient voltages incidental to the operation of transformers, series transformers, or reactors

FEATURES

1. No reactor loss or voltage drop on full cycling positions

2. No arcing duty imposed on Tap Selector Switch

3. Longer arc clearances for load switching

4. High speed "make" and "break" on load switching with minimum shock from acceleration or deceleration of inertia load of parts

5. Combination spring-accelerated and direct drive

6. Low contact maintenance cost

7. Special arcing tips provided on Load Transfer Switch contacts

8. Contact materials selected to minimize wear from friction

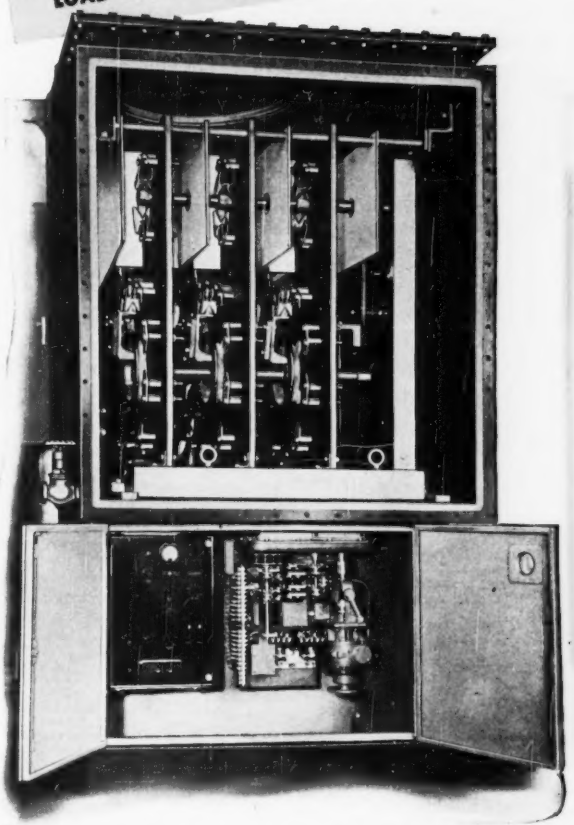
9. Position indicating, pilot switching, and mechanical drive limit equipment are solidly tied in with those parts requiring definite timing

10. Minimum space requirement, at high dielectric level, through the use of high insulating strength materials as combination mechanical supports and barriers between phases

11. Melamine bonded surfaces used in areas subjected to arcing or arc gases

12. All insulating surfaces are mounted in a vertical plane

MOLONEY QUALITY IS NOW AVAILABLE IN AUTOMATIC STEP VOLTAGE REGULATORS, REGULATING TRANSFORMERS AND LOAD RATIO CONTROL TRANSFORMERS



New Moloney three-phase Load Tap Changer with automatic controls. Top assembly contains Tap Selector Switch, Load Transfer Switches and Reversing Switch. Motor drive and auxiliary equipment are at lower right. Automatic controls are at lower left. Moloney Automatic Control equipment features a super-sensitive voltage regulating relay and an electronic time delay circuit. A complete line of remote-manual and automatic controls and associated equipment is available.

MOLONEY ELECTRIC COMPANY

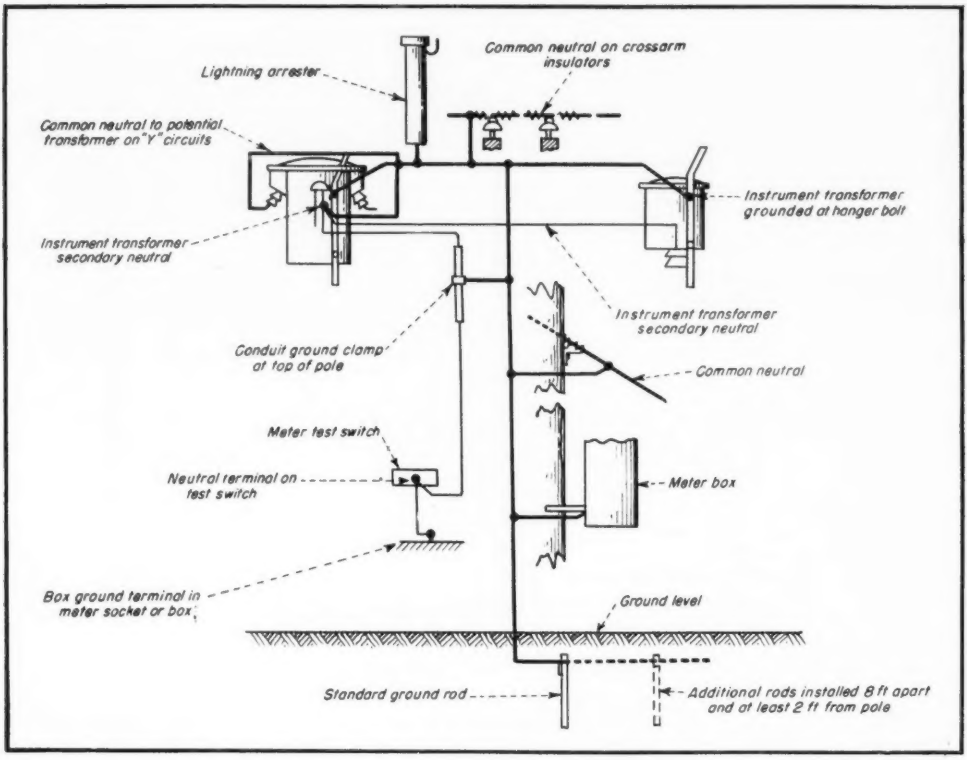
FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONTARIO, CAN.

Another Superior **MOLONEY** *Product*

Write for Bulletin No. LTC-901 describing in detail the new Moloney Load Tap Changer with Automatic Controls.

Grounding Details for Pole Metering Circuits 460 Volts and Above

Diagram shows items requiring ground connections. Instructions are included for the grounding procedure. This presentation is an adaptation from meter practices of Mississippi Power & Light Co, Jackson, Miss.


Lightning arrester
Common neutral on crossarm insulators
Common neutral to potential transformer on "Y" circuits
Instrument transformer grounded at hanger bolt
Instrument transformer secondary neutral
Instrument transformer secondary neutral
Conduit ground clamp at top of pole
Common neutral
Meter test switch
Neutral terminal on test switch
Meter box
Box ground terminal in meter socket or box
Ground level
Standard ground rod
Additional rods installed 8 ft apart and at least 2 ft from pole

EVERY pole metering equipment must have a reliable ground whether it be common neutral network or special ground made for the purpose or both.

Where there is no neutral ground available at least two rods must be driven 8 ft apart.

In every case special grounds must have a resistance of 25 ohms or less. When necessary additional rods, longer rods, or standard rods driven deeper should be used.

Grounding conductors must be No. 6 solid copper or larger size.

A separation of at least 1 in. must be maintained between grounded equipment and ungrounded equipment. Where this separation is not possible, equipment must be bonded.

All instrument transformer cases, conduit, and instrument transformer boxes, at the top of the pole, must be connected to ground.

Meter installations with potential transformers and or lightning arresters must be connected to at least one ground rod at the pole in addition to the neutral ground.

All instrument transformer neutrals should be grounded at top of pole.

Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.

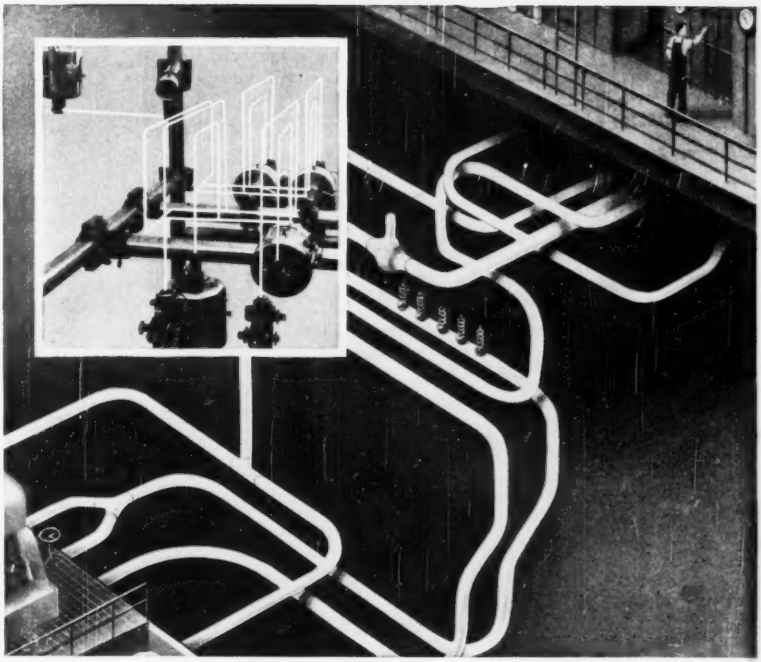
Unique Technical Backing of an extensive organization with an international reputation in both process and fabrication engineering.

Complete Facilities for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.

Top Welding Performance assured by specially designed equipment and exclusive employment of master operators.

Quality Control embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

On-Time Delivery made possible by a flexible planning group authorized to re-route work to meet promised dates.



Exclusive Equipment aids Seven New Power Installations

To be able to solve economically the exacting problems expected with the advent of future superpower stations, Kellogg's engineers and scientists some years ago began a search for a method of positively determining stresses and reactions in power piping.

Although the general mathematical method developed earlier by Kellogg is capable of solving problems of any complexity, the time required for computing the more intricate piping systems becomes impractical.

Here's what Kellogg eventually created—an exclusive, positive apparatus for accurate determination of stresses and reactions in the most complicated piping systems—a model tester, with specially-created and patented, electrical measuring heads.

Although this equipment was used on important work for the Navy during the war, the apparatus is now serving the purpose for which it was originally intended.

For example, with today's expansion and improvement in power generating stations, Kellogg has used the "tester" for analyzing the stresses in the re-heat steam cycle connections for the first two stations to operate on the re-heat cycle at 1000° F. Five additional proposed installations have been similarly studied, some of which will operate up to 1050° F. This makes a total of seven completed jobs with more "in the works" at the present moment.

Actual experience shows that the Kellogg Piping System Model Tester provides results that are borne out under actual operating conditions. Power engineers are able to take economic advantage of these analyses . . . permitting marked savings in material purchases.

The development of equipment such as this is another reason why Kellogg is enjoying so large a share of the critical, high-pressure, high-temperature piping business today.

If you are interested in further information on this advance in power piping design, Kellogg piping engineers will be glad to discuss it in detail with you.

To master temperature, pressure and chemicals use

M. W. KELLOGG

process equipment

VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS

The M. W. Kellogg Company, Inc. (A Subsidiary of Pullman, Inc.)—Offices in New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris.

LOADS up to 1,000 lbs are handled quickly and easily by this mobile utility crane built by Los Angeles Department of Water and Power. Removing dirt from underground vault excavations and lifting manhole covers are only two of the many useful duties it performs

Speed Excavation with Mobile Utility Crane

R. EDGAR JENKINS
Associate Automotive Engineer
Los Angeles Department of Water and Power

FOR LIFTING LOADS up to 1,000 lbs in underground distribution work, the Los Angeles Department of Water and Power has built the mobile utility crane shown. It is designed to handle buckets of earth from underground vault excavations, remove heavy vault covers and perform other light lifting work wherever required.

The crane was built up from a Willys Overland Universal Jeep and a davit-type crane with a power-driven winch. A special frame was made to replace the standard front bumper of the jeep, on which was mounted a 5,000-lb capacity winch driven from the truck engine and capable of lifting and lowering loads under power.

To reach over into excavations a clearance of at least four feet was required over the front of the jeep frame, and a minimum clearance of 11 ft was required under the hook in its top position to lift the dirt buckets high enough for dumping. The fully-revolving davit crane was made with a retractable pipe boom giving a clear height of 12 ft 6 in. to the top sheave in the extended position, and a maximum height of 9 ft 6 in. in the lowest (running) position.

Heavy duty rubber-tired casters on horizontal swivels at the outside edges of the frame take the strain off the front springs and knuckle joints of the jeep when the crane is in operation, adding to its stability. The casters can be swung up and locked out of the way when the jeep is being driven from one job to another. When on the road, the boom is swung back over the rear of the jeep and tied down, making the over all height less than 10 ft.

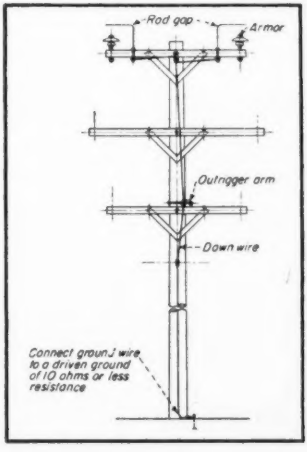
Utility of the mobile crane is augmented by its short wheelbase of 80 in., allowing it to be turned in a very small space. Four wheel drive gives plenty of traction for most conditions.

Rod Gaps Provide 34.5-Kv Line Protection

FRED VON VOIGTLANDER
Commonwealth Services, Inc
Jackson, Michigan

INSTALLATION of simple rod gaps, shown, has proved effective as an economical substitute for an overhead ground wire on 21 miles of double circuit 34.5-kv wood pole line in central Illinois. Direct strokes were the cause of much pole shattering as the line was built some years ago without a shield wire. The installation of a ground wire would have required extensions on all poles and in many cases pole reinforcement or replacement. The cost of installing gaps was about $300 per mile overall, compared to an estimated cost of $2,000 per mile for the overhead ground wire installation.

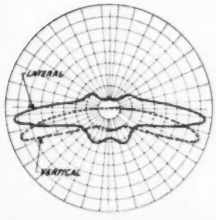
The metallically connected 34.5 kv system consists of 70 circuit miles, 28 miles on single circuit pole line and 21 miles on double circuit pole line. This line mileage, operated with isolated neutral, results in ground fault currents of the order of only 10 amp. which are so small that arcs are self-extinguishing. There are no transpositions in the line and phasing is arranged so that all gaps are placed on the same phase in the top position throughout. Direct strokes flash the



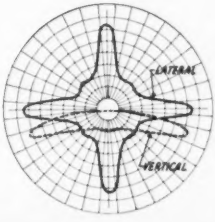
GAPS are placed on same phase in top position throughout and connected to a ground of 10 ohms or less resistance. Gaps are provided in this case on top phases of two circuits, no transpositions used. Gap spacing is 7 in.

PERMALUX
STAINLESS STEEL REFLECTORS

TYPE III



4 WAY



The Permalux stainless steel reflectors were introduced by Joslyn 2 years ago—they have demonstrated the effectiveness of stainless steel for open type luminaires—now available in two new improved designs.

Light distribution—4-way for mounting at intersections—Type 3 between intersections—provides high utilization of the source lumens.

18-8 Stainless steel reflectors with hard highly polished specular surface assures high, permanent reflectivity.

Attractive appearance—the two unique modern designs combine high efficiency with low cost.

The Permalux Reflectors will fit all Joslyn street heads and can be adapted to most other metal or porcelain heads.

Modernize your old fashioned, open type luminaires with the new Joslyn Permalux Reflectors.

Branch offices in principal cities

THE JOSLYN CO.
THE SOUTH EAST-JOSLYN CO.
SOUTHERN JOSLYN CO.
JOSLYN SOUTHWEST CO.
JOSLYN PACIFIC CO.

JOSLYN

Complete Pole Line Equipment

20 NORTH WACKER DRIVE, CHICAGO 6, ILL.

G. AND
PPLY CO.

gaps to ground and are rendered harmless as gaps are placed on every other pole and are connected to a 10 ohm driven ground at the pole base.

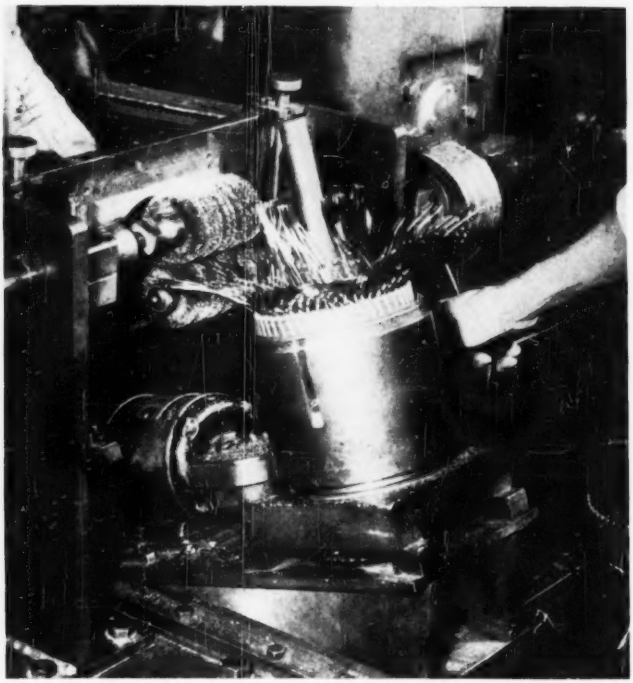
The rod gap spacing was set at 7 in. This spacing was determined by the 60 cycle wet arcing distance of the insulators. The principle here is to flash the gaps at surge voltages safely under the withstand value of the line insulation, while not flashing at voltages so low as to greatly reduce the line basic insulation level.

Such installations are feasible on systems equipped with ground fault neutralizers. Various types of gaps may be used. Care must be exercised to apply gaps only on lines without transpositions lest phase to phase faults result from gaps on two phases flashing over simultaneously. Adequate insulation from the other two phases must be provided for the down wire from the gap to ground. This is usually accomplished by using a short outrigger arm.

Experience to date with this type of protection has been quite satisfactory and additional installations are being planned.

• • •

Power Brushing Speeds Removal of Enamel Insulation



ENAMEL INSULATED WIRE is forced between counter-rotating brushes to remove coating on ends of rotor leads, insuring solid solder contacts of the leads in the commutator

SUBSTANTIAL CASH SAVINGS per production hour for each machine operation have been made possible by power brush stripping of fine gage wire used in the manufacture of electric motors. Use of revolving brushes has speeded up operations by removing insulation faster without damage to leads.

This power brushing method was originated in the technical laboratories of The Osborn Manufacturing Co, Cleveland, Ohio. The apparatus consists of a variable speed lathe with an operating range between 100 and 5,000 rpm, and power driven brushes.

Stripping of the enamel insulation from the copper lead wire in the rotor fields is done to insure that there will be solid solder contact of rotor leads in the commutator.

The rotor is placed in a fixture with the wires extended and is rotated at 8 rpm forcing the wires between the counter-rotating brushes. The insulation is removed for a distance of approximately 1 in. or a total of 1½ in. from the end of the wire. The rotor is then removed from the fixture and the wires are trimmed to length, within the cleaned area, and the leads are automatically soldered.

• • •

Transformers Rebuilt at Saving of 25-45%

SMALL, inefficient, badly deteriorated transformers are being rebuilt by Alabama Power Co at 55-57% of current price for new units. The rebuilt transformers are equivalent to new transformers and some have higher ratings than formerly.

All of the old transformers were water-cooled and have been made self-cooling by the addition of radiators. Gas-sealed construction has replaced open type design; old oil has been re-refined. Where original parts and materials could not be salvaged for re-use, they were replaced with new parts and materials of modern design.

In one instance, three 2,500-kva, 63.5/110–25.1/44–2.4-kv, three winding transformers were rebuilt from units which were rated 1,333 kva, 66/33–13.2/6.6-kv, two winding. Except for the core iron, these transformers were entirely redesigned and were reconstructed and tested four months after design was started. Included in the testing procedure was a load test.

During the past ten years, 24 110-kv transformers have been rebuilt—17 of these have new ratings varying from 2,500 kva to 10,000 kva—and also a fewer number of transformers rated at 44 kv.

What does USKON® Electric Heating *mean to* Electric Light and Power Companies?

Uskon is first of all the nearest thing to perfect heat yet devised . . . from the standpoint of human health . . . for its extremely efficient utilization of power services.

THE MOST HEALTHY HEAT EVER PERFECTED

Uskon provides uniform heat from head to foot, primarily warming *objects*, not the air. Floors and walls are always warm, humidity remains constant. The air is more fresh, and colds are fewer. Uskon represents what is unqualifiedly the greatest sanitary and hygienic advance in the history of home heating. To be a prime factor in bringing it to more and more people is a fact of great public relations value to the utilities.

PROVIDES MOST EFFECTIVE USE OF SERVICE LINES

But Uskon approaches the theoretically perfect heat for other reasons too. It heats people and objects. Uskon does not have to count on a large excess capacity to overcome lag and give fast pickup as do convection heat systems. With Uskon, detailed engineering specifications are completed for each home. This careful design means that the utility is assured the most efficient use of its equipment and services.

AVOIDS SEVERE STRAIN ON SECONDARIES

Most electrical heaters marketed today are of the convection type. They labor to heat the *air*, building up sudden heat loads and putting severe strain on the utility system. Uskon always supplies radiant heat—directly balancing the body heat loss. With group installations, Uskon shifts the wintertime peak from the evening to the morning, just when the distribution transformers are in the best position to handle it. And because of Uskon's individual room control, peaks in the load are reduced to the absolute minimum through diversification.

THE PATTERN FOR THE FUTURE

Uskon electric radiant heat, because of its healthfulness, cleanliness, convenience and ease of operation, is destined to play an even larger part in home heating. Uskon is a product of United States Rubber Company and is distributed exclusively by Graybar Electric Company.

Electric heat of the radiant type, like Uskon, reduces peak loads and provides favorable load factors.

We welcome inquiries seeking more complete information about Uskon. One of our sales engineers will supply any facts required. Write Electrical Wire and Cable Department, United States Rubber Company, 1230 Avenue of the Americas, New York 20, N. Y.

Uskon is an electrical radiant heating system utilizing rigid panels placed in the ceiling

USKON USES ELECTRICAL ENERGY ECONOMICALLY BECAUSE:

1. **Effective utilization of radiant waves primarily heats people and objects—not air.**
2. **Rigid engineering specifications of installation and insulation are observed.**
3. **Uskon allows individual room control.**

UNITED STATES RUBBER COMPANY

SERVING THROUGH SCIENCE

Electrical Wire and Cable Department, Rockefeller Center, New York 20, N. Y.

Announcing the
40% Lighter
for Single Pole mounting!

YOU CAN BE **SURE**..IF IT'S

Westinghouse

New URL-8 Voltage Regulator

a low cost answer

to rural load problems

Now you can deliver the kind of service that assures more revenue from heavily-loaded rural areas. You can do it economically too, because this new 8-step regulator was designed with this aim—your paramount interest—in mind: *Combine close voltage regulation with new installed economy!*

These remarkable features indicate how well this has been accomplished:

40% LESS WEIGHT FOR SINGLE-POLE MOUNTING: The famous Hipersil* core-and-coil assembly—a feature of Westinghouse distribution transformers—has been incorporated in the URL-8 to slash weight by 40 per cent . . . to cut your installation cost with simple single-pole mounting in ratings up to 100 amperes at 7620 volts.

SIMPLIFIED TAP CHANGING AND CONTROL: A simple direct drive on the tap changer cuts maintenance to a minimum. The control cabinet may be mounted integrally with the regulator or on the pole below the regulator. A switch provides for manual or automatic control.

IMPROVED REGULATION . . . VOLTAGE CONTROL: A new voltage-regulating relay provides suitable inverse-time delay before initiating tap change. This means less contact operation . . . longer contact life. Adjustable line-drop compensator is also included in the relay.

**Reg. in U.S. Pat. Off.*

8 OR 4-STEP OPERATION: To meet requirements for any load condition at minimum cost, this new regulator is available for *4-step* as well as 8-step operation. In either type you get every URL feature plus important extras like safer, cover-mounted bushings and coordinated surge protection by externally mounted arresters.

FOR FURTHER INFORMATION on the new URL-8 Regulator, simply call your Westinghouse representative or write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-70648

Westinghouse

VOLTAGE REGULATORS

LOAD BUILDING

Utility Service Solves Customers' Problems

NORTHWEST UTILITIES participating in their own Research Advisory Service use these and other similar pieces overprinted with their name to give the service to their customers. Findings of an almost unlimited number of research laboratories, manufacturers, consultants, government agencies, and trade and professional organizations are available without charge

LADNER ROSS
Research Advisory Service
Portland, Ore.

To HELP their customers solve production problems, develop new products, expand their markets and create more jobs, utility members of the Northwest Electric Light and Power Association have for four years sponsored a Research Advisory Service. For less than the cost of one additional salesman, each of the six participating companies has made available to its customers the best available scientific and research brains and ability when and as needed.

The service operates independently from, but utilizes the same proved methods as, the original Research Advisory Service set up in 1937 by B. H. White, vice-president of Liberty Bank of Buffalo, New York. Its primary purpose is to serve as a clearing house dealing with discoveries resulting from research in new or unfamiliar materials, machines, products and processes. If the answer to a problem is already known to someone, somewhere, the service tries to establish contact between the inquirer and the man or company with the answer. By investigating and cataloging established sources of information it endeavors to promote voluntary circulation of useful, nonsecret knowledge. It does not engage in industrial research, nor does it accept problems which belong in the sphere of consulting engineers, testing laboratories, and other recognized consultants such as law or medicine.

The great bulk of inquiries is on problems which have already been solved, and a live and active library of 1,120 varied reports is available for prompt reproduction to answer such inquiries. In four years of operation, 360 original problem reports on inquiries from utility company customers in the four Northwest states and British Columbia have also been accumulated and supplied to all participating companies. Some 1,500 organizations have contributed to these local reports, including manufacturers, consultants, government agencies, research institutions, universities, trade and professional organizations, and trade and technical journals.

12,000 Sources

If the answer to a problem is not already available in the files, a list of some 12,000 sources is consulted to determine the five or more best qualified and most likely to have the answer, and the question forwarded to them without identifying the original inquirer. When replies have been received, a complete report is made up and sent to the utility originating the inquiry to be transmitted to its customer.

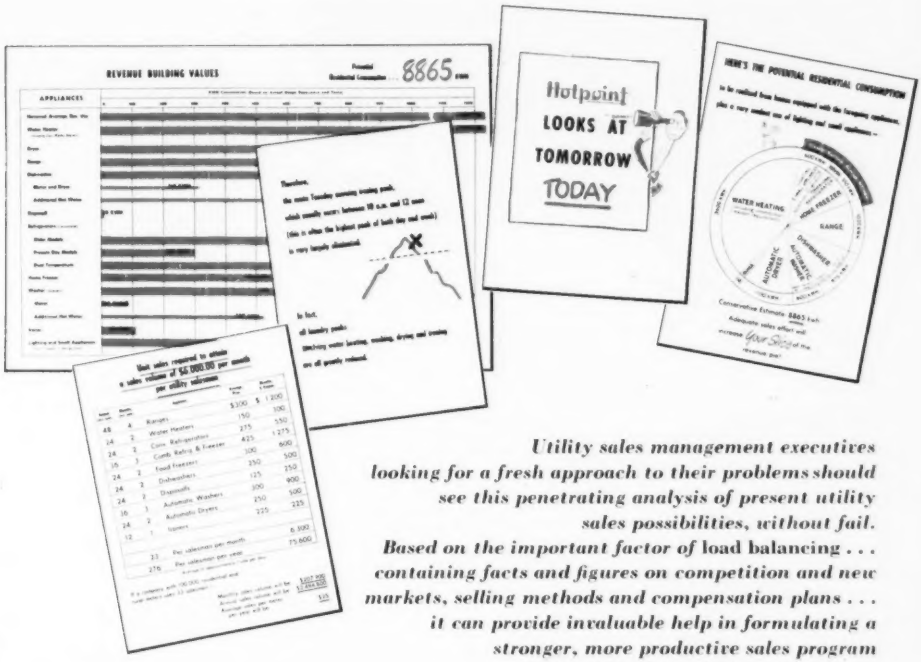
Although many of the problems submitted are electrical in nature, the service handles a wide variety of problems in practically every field, all without charge. Listed in the pocket index used by the utility contact man are such diverse subjects as adhesives, construction, lubricants, management, packaging, plastics, raw materials and wastes. Better quality reports on new problems—those with widespread interest—are added to the library and listed in revisions to the index from time to time. In between such revisions, monthly field bulletins listing new reports available are sent to utility sales personnel concerned with commercial and industrial customers.

Cost of the service is shared by the participating companies on the basis of their relative gross electric revenues. As mentioned previously, the cost to each company is less than the cost of one additional salesman. Within individual companies, the

"One of the most thought-provoking presentations it has been my pleasure to hear."

CARL T. BREMICKER
Vice President in Charge of Sales
Northern States Power Company
Minneapolis, Minnesota

. . . a new and thoughtful "balanced load" study designed expressly to meet today's utility sales objectives



Utility sales management executives looking for a fresh approach to their problems should see this penetrating analysis of present utility sales possibilities, without fail.

Based on the important factor of **load balancing** *. . . containing facts and figures on competition and new markets, selling methods and compensation plans . . . it can provide invaluable help in formulating a stronger, more productive sales program and in stimulating dealer cooperation.*

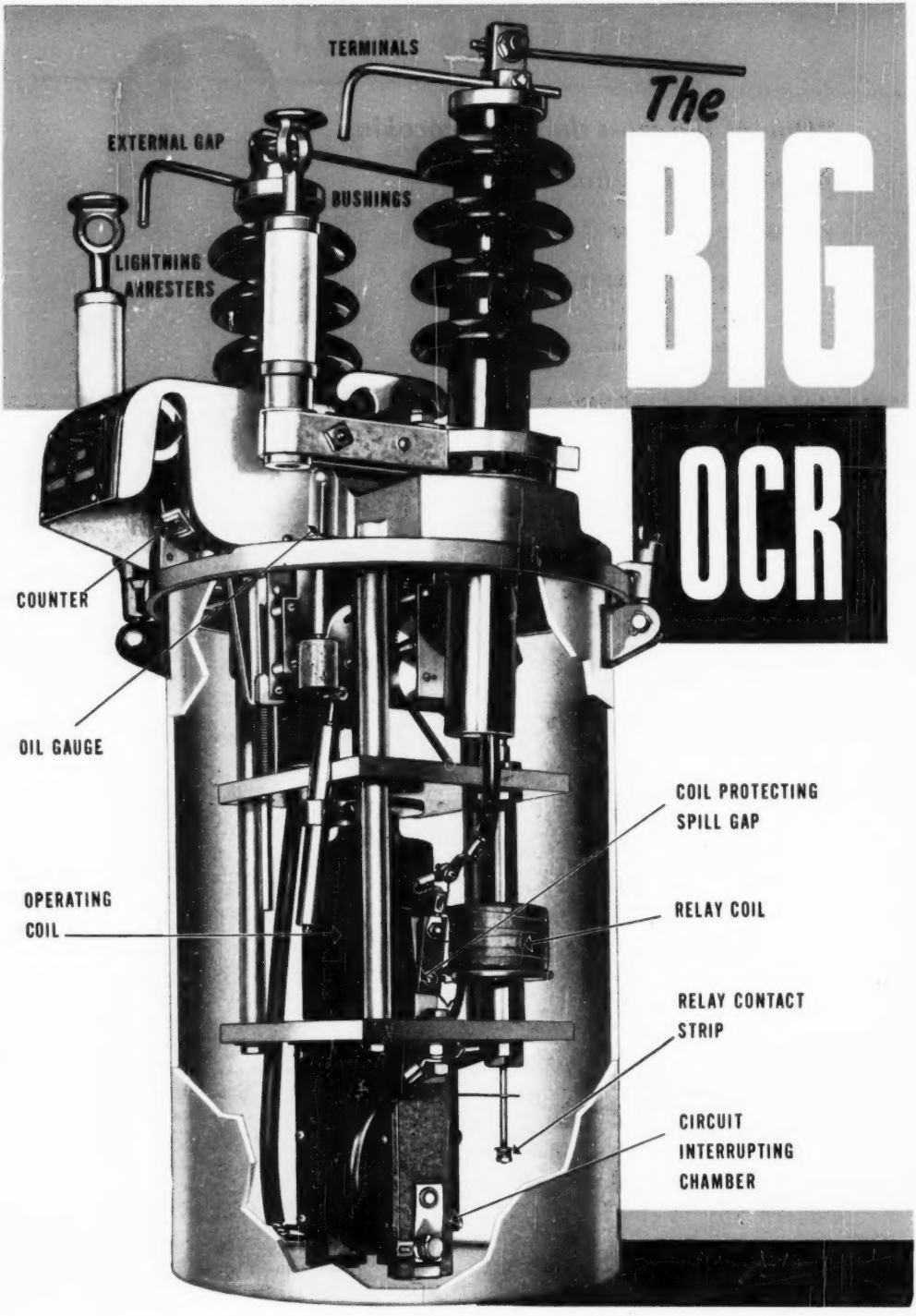
If your sales management group is interested in seeing this presentation, get in touch with

The Hotpoint Committee on Cooperation with Utility Executives, Hotpoint, Inc., 5600 W. Taylor Street, Chicago 44, Illinois.

Hotpoint

(A GENERAL ELECTRIC AFFILIATE)

The BIG OCR


TERMINALS
EXTERNAL GAP
BUSHINGS
LIGHTNING ARRESTERS
COUNTER
OIL GAUGE
COIL PROTECTING SPILL GAP
OPERATING COIL
RELAY COIL
RELAY CONTACT STRIP
CIRCUIT INTERRUPTING CHAMBER

KEARNEY

The only full size OCR on the market today

DESIGNED and constructed for the increased loads of tomorrow this OCR has many advantages for the far-sighted user. The larger physical dimensions provide such desirable features as: . . . . . .

All of which means better line protection and less frequent maintenance trips. This larger automatic OCR is available with time current characteristics that permit replacement of any OCR on your line today. Operating characteristics charts are available—just specify the rating in which you are interested when making your request.

- MORE OIL
- HEAVIER CONTACTS
- LARGER BUSHING
- GREATER CONTACT SEPARATION
- TWO FULL RATED NEMA LIGHTNING ARRESTERS

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Ave.
St. Louis 10, Mo.
Canadian Plant • Guelph, Ontario

Always Specify JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. *for the Job . . .*

Better Construction – *SAFER* Maintenance

Research Advisory Service can be coordinated with no difficulty by the industrial development group, supplementing its own industrial and power sales activities.

In practice, the service has given the utility sales contact staffs an additional avenue of approach to their customers. It is an excellent public relations medium and provides another way in which the power company can serve its communities. By providing local business and industry with information to help solve problems of production, marketing, processing and management, the utility benefits along with the community and the region.

Electric Replace Blast Furnaces at Chemical Plant

ELECTRIC FURNACE at the Southern Ferro-Alloy division of Tennessee Products & Chemical Corp, Chattanooga, Tenn., showing the water cooled electric coils and connections at the huge electrodes. Control of amount of alloy produced is advantage over blast furnace

WHILE MANGANESE and silicon alloys may be produced as cheaply in a blast as in an electric furnace, yet there are many advantages which can be obtained through use of electric operations.

Such has been the experience of the Southern Ferro-Alloy division of Tennessee Products & Chemical Corp, at its Chattanooga, Tenn., plants.

During the war years when there seemed to be an endless demand for both silicon and manganese the company kept its blast furnaces in full time operation. At the same time the demand for higher quality grew. Since the war, production for these two products has been more on a customer specification basis than heretofore.

To meet these exacting requirements and to effect control production of manganese cheaply, the company has changed entirely to electric furnace operations.

At present there are nine electric furnaces in operation, producing both silicon and manganese alloys. The nine range in size from 2,000 kva to 6,000 kva. They can be used also for the production of low carbon pig iron, chrome and calcium carbide.

Due to the terrific heat generated in the furnace, all cables and electrical connections are water cooled. Cables are so connected to the huge carbon electrodes as to prevent kinking. Water is circulated through test faucets so that temperature can be closely watched.

Power for the furnaces is brought from the substation to the furnace transformer at 12,000 v and then stepped down to approximately 100 v.

One of the major advantages of the electric over the blast furnace is that the amount of manganese alloy produced can be controlled at minimum cost. The electric furnace also allows for variable production and higher manganese content. Greater purity can be obtained for the high quality product.

In the case of silicon alloy, the electric furnaces enable production in any prescribed grades up to 95 percent.

While unit cost has been greatly reduced, better quality has been obtained in addition to controlled production.

All furnaces have automatic pilot regulators.

The electric furnaces have a combined 40,000 kw load and constitute the largest single customer of the Chattanooga Electric Power Board, with a power bill of over $100,000 a month.

"Enterprise" Numbers Improve Customer Service

ARRANGEMENT with the telephone company for "Enterprise" telephone numbers, on which the company accepts toll charges, has improved customer service for the Wisconsin Power and Light Co. The company territory consists almost exclusively of small communities and rural areas. Enterprise telephone numbers connect customers to the nearest operating headquarters of the company. Since toll charges have been eliminated customers tend to contact the company more readily in case of trouble which they attribute directly or indirectly to the company, or for whatever business they may wish to contract.

Use of two-way radio for dispatching trouble men in certain localities, in connection with the "Enterprise" telephone numbers, has reduced the force of service employees and at the same time improved the attitude of customers.

build more load with electric heat

Via the slidefilm, "Heat . . . Where You Want It," you can take your customers on a "seeing-is-believing tour" of dozens of plants where industrial electric heaters are doing a more efficient heating job in various applications on many kinds of machinery and equipment.

Then, to help them pin down the application of electric heat in their own jobs, there are five application bulletins—one on each of the major applications depicted below. In addition to the sound-slidefilm, each program kit contains 50 copies of each of these five application bulletins.

Available through your local G-E office, the complete kit (including slidefilm, record, and application bulletins) can be purchased for $15. If you haven't seen it, just clip the coupon to indicate when you'd like to have a showing. Or use it to order complete program kits for your own use.

HAVE YOU SEEN THESE OTHER MORE POWER TO AMERICA PROGRAMS?

Textile Mill Modernization
Electric Arc Welding
Oil Field Electrification
Industrial Power Distribution
Sewage Treatment
Resistance Welding
Materials Handling
Electric Transit

GENERAL ELECTRIC

Sect. C684-12
Apparatus Department
General Electric Co.
Schenectady 5, N. Y.

( ) We'd like a showing of your MPA program on Industrial Electric Heaters

( ) Send us ____ program kits @ $15.00 each.

Name .....

Company .....

Address .....

City ..... State .....

NEW EQUIPMENT

Watthour Meters

SWITCHBOARD WATTHOUR METERS, Type LCF for polyphase circuits and Type JF for single-phase circuits, are offered in all standard current and voltage ratings.

Adjustments for full load, light load, power factor, and element balance are accessible from the front without removing the meter from the panel. A micrometer slide-wire device permits power factor adjustments to be made with a screwdriver.

The semi-flush-mounting meter enclosure fits a $6\frac{3}{8}$ x $6\frac{3}{8}$ in. opening in the panel and has a mounting flange to secure the meter to the front of the panel by four screws. Stud terminals are provided for back connections.

Sangamo Electric Co, Converse and Burton Sts, Springfield, Ill.

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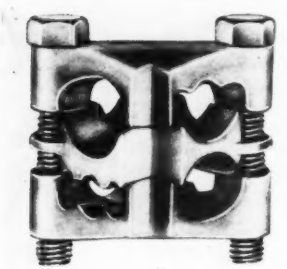

Multiple Purpose Connector

A MULTIPLE PURPOSE CONNECTOR, the Multitap connector, is made in three sizes to accommodate a range of copper wire sizes from No. 1 strand to 1,000 Mcm inclusive on the main circuit, and from No. 6 solid to 1,000 Mcm on the tap circuit. Three sizes of aluminum connectors for aluminum to aluminum connections will accommodate main circuit wire sizes from No. 1 ACSR to 795 Mcm ACSR, and from No. 6 ACSR to 795 Mcm ACSR on the tap circuit.

The connector is applicable for making cross, parallel, tee, and end to end connections. The manufacturer reports that because of the design of the spacer bar and the come-along piece, an even pressure is maintained on both conductors. Accommodation of the wide range of conductor sizes is possible because the spacer bar is reversable.

W. N. Matthews Corp, 3805 Delor St, St. Louis 16, Mo.

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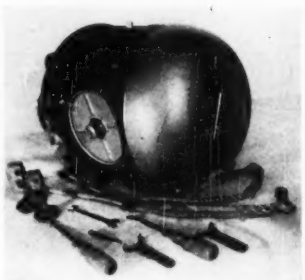


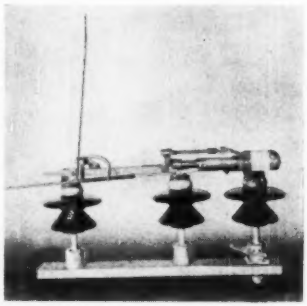
Cable Spinning Machine

DESIGNED PRIMARILY for binding three individual power cables into a compact triangular pattern is the Neale Model K pull-type spinning machine. The apex of the triangle into which the cables are bound points downward, the strand lying in the groove formed by the top two cables. Machine can also be used for spinning a single cable.

A rotatable spinning drum revolves on five ball bearings at each end of the machine. Machine rotation is caused by two rubber friction drive wheels which are themselves rotated by the spinning wire as it feeds off the machine. A revolution of the spinning drum occurs whenever 13 in. of spinning wire is pulled off each of the two coils of wire on the drum.

Machine capacity is three 2 in. diam cables. Each wire has a 13 in. lay and the wires are spaced so they will lie $6\frac{1}{2}$ in. apart. This amounts to lashing the cable twice in one operation.

Cable Spinning Equipment Co, Topeka, Kan.



Air Interrupter Switches

GROUP OPERATED outdoor air switches are available in the Three E line up to 600-amp interrupting rating at 46-kv, 200-amp rating up to 69 kv, and higher rating for voltages to 138 kv. The switches, manually or motor operated, can be used for interrupting load currents, sectionalizing feeders and distribution circuits, and other interrupting applications.

The two part interrupter unit is the dry type. Mounting the interrupter unit on the hinge end of the switches permits use of an integral actuating mechanism for the arcing contacts. These interrupter units can be applied to other switches already in service.

Reciprocating or torsional control type of mechanism is optional. Illustrated is a single pole of a 34.5-kv switch, as described in Bulletin 331.

Electrical Engineers Equipment Co, Melrose Park, Ill.

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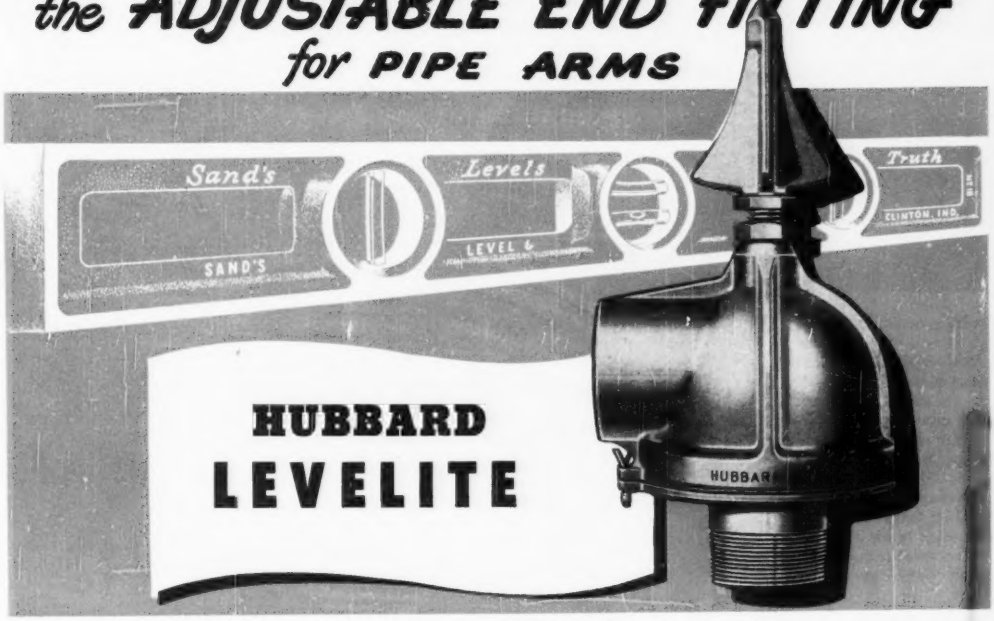
Suspension & Strain Clamps

SUSPENSION AND STRAIN CLAMPS, for use with ACSR and all-aluminum conductors, are said to eliminate the hysteresis and eddy current power losses caused by magnetic ferrous clamps on

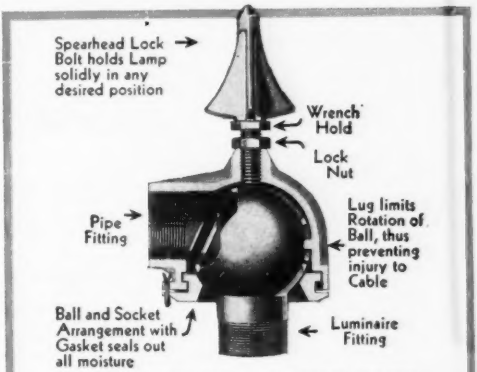
the ADJUSTABLE END FITTING *for* PIPE ARMS



The Hubbard LEVELITE has been designed to provide a much needed flexibility on street lighting installations. Luminaires may be leveled or purposely tilted in any direction, and permanently locked in that position. Many problems in lighting can be solved by this fixture. Poles which are set some distance in from the curb might require a tilt away from the pole to throw more illumination to the roadway. Special conditions such as building obstructions, landscaping, consisting of trees which it is preferred not to trim, and instances where unforeseen changes occur after lines are in service can usually be handled in a practical manner by LEVELITE flexibility.

Mechanical working of the Hubbard LEVELITE is explained by the illustration at the right. A ball and socket movement is used, effectively sealed by a lead gasket. Rigid setting in position is maintained by a single "spearhead" bolt and lock nut. Changes may be made easily and quickly before, during or after installation.

A most popular combination is the HUBBARD LEVELITE and the new HUBBARD UPSWEEP Street Lighting Brackets. Write for a copy of the Hubbard Linebuilder describing these Brackets if you have not already received a copy.

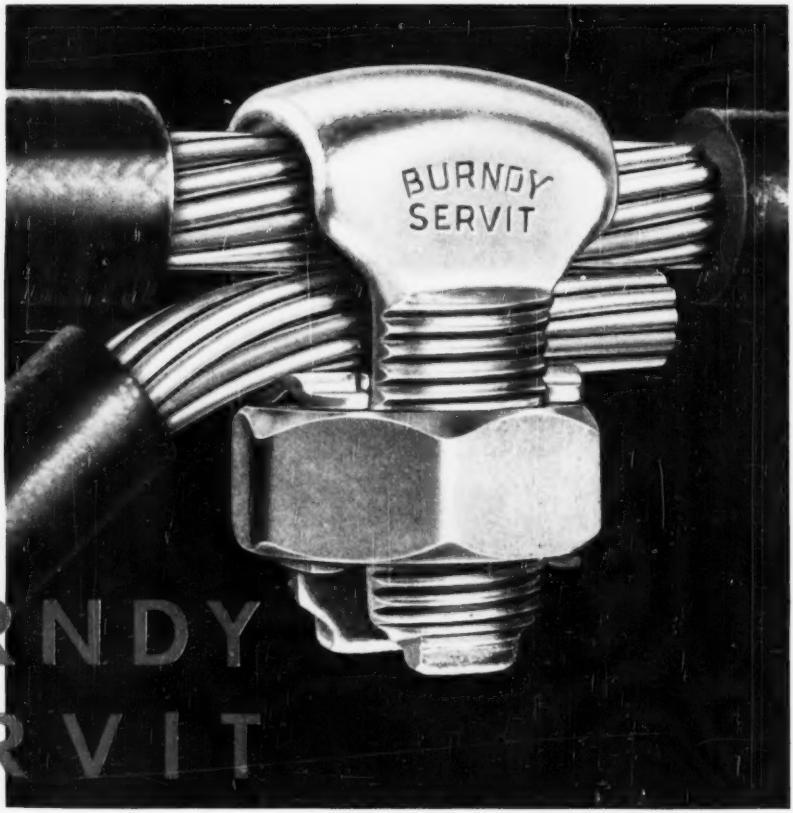

Spearhead Lock Bolt holds Lamp solidly in any desired position
Wrench Hold
Lock Nut
Pipe Fitting
Lug limits Rotation of Ball, thus preventing injury to Cable
Ball and Socket Arrangement with Gasket seals out all moisture
Luminaire Fitting

A MAXIMUM SWING OF 34° IS POSSIBLE IN ANY ONE DIRECTION, 17° IN ANY DIRECTION FROM THE VERTICAL, OR CENTER LINE OF THE LEVELITE.

Stock No.	For Pipe Arm Nominal Size—Inches	Luminaire Attachment Thread—Inches	Approximate Shipping Wt., Lbs., 100 Pcs.
3279	1¼	1¼ (pipe)	563
3281	2	1¼ (pipe)	900
3282	2	2 (pipe)	944

HUBBARD AND COMPANY

PITTSBURGH · CHICAGO · OAKLAND, CALIF.



BURNDY SERVIT

ENGINEERED FOR PERFORMANCE....NOT FOR BULK

Want a high conductivity connection without mere bulk and bigness? Want strength without dead weight? Then the Burndy SERVIT is your connector. Servit alloys are expertly balanced to provide high conductivity and strength with minimum size and weight.

Compare a SERVIT with any other split-bolt connector of the same rating. You'll find it lighter and more compact. SERVITS are made stronger by design, not by bulk . . . they are engineered for top-level *electrical* performance.

SERVIT USERS GET...

- **faster installation because Servits are not unwieldy—go on easily with just a wrench!**
- **surer installation because Servits can take high tightening torques.**
- **long years of low-resistance, trouble-free connection!**

25 YEARS OF SERVICE

Connect with

BURNDY

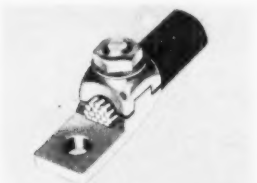
NEW YORK 54, NEW YORK

Western Branch: Vernon 11, California • Canada: BURNDY CANADA, LTD., Toronto 8

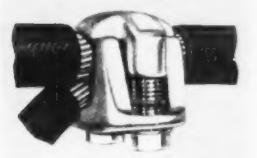
ENGINEERED FOR PERFORMANCE....NOT FOR BULK

PLANT WIRING
GOES FASTER WITH—

SCRULUG KPA—Low-cost, indoor lug for service switch, terminal block and similar connections. Ideal in close quarters. Installed with screwdriver or pliers—convenient cable range in each size.



QIKLUG QA-B—Rugged, compact, withstands stress and vibration. Installed with wrench. No separate parts. Each unit takes convenient cable range.



OKLIP KVS—Heavy duty service connector, affords high contact pressure between cables. No loose hardware, rounded edges for easy taping.

VERSITAP QPX—Can be used as a tee, tap, cross, parallel or end connector. Takes a wide range of cable combinations.

ASK YOUR BURNDY DISTRIBUTOR

He's equipped to promptly serve your Burndy connector requirements from stock. He can also help you with both Burndy special-purpose and Hydent line connectors.

BURNDY

ENGINEERED FOR PERFORMANCE . . . NOT FOR BULK . . . ENGINEERED FOR PERFORMANCE . . . NOT FOR BULK

high-current transmission lines. They feature a non-magnetic body that reportedly breaks the magnetic path around the conductor.

Bodies of the clamps are drop forged from high strength aluminum alloy and heat treated. Clamping keepers and machined connectors on the clamps are made of drop-forged steel with connecting pins, clamping bolts, nuts and lock washers also of steel construction. Suspension clamp is illustrated.

Brewer-Titchener Corp., 111 Port Watson St. Cortland, N. Y.

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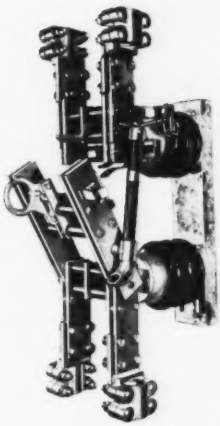

Regulator By-Pass Switch

THE WORK OF FOUR DISCONNECTS needed for removing regulators from the line is reportedly accomplished by a new 1,200-amp regulator by-pass disconnect switch. The steps required in removing regulators from the line, performed with one switch operation, are: Regulator is by-passed, regulator leads are disconnected, and the exciting current is interrupted in an arc-extinguishing auxiliary switch.

Heavy bus-bar construction and silver-to-silver overlay contacts of line-pressure design form the conductivity path. The switch is available with or without an auxiliary switch in voltage ratings of 7.5 or 15 kv.

James R. Kearney Corp., 4236 Clayton Ave., St. Louis 10, Mo.

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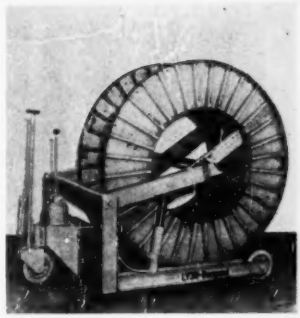
Cable Reel Truck

CABLE REELS of various diameters can be handled by a new cable reel truck which requires no further adjustment to accommodate different widths. Although trucks of different sizes and capacities are available, a model suitable to handle the user's largest reel



will also pick up and transport smaller ones.

Two hydraulic hoists are incorporated in the lifting arrangement to raise the carrying arms of the truck. A single speed hydraulic hand pump provides the power to elevate the lifting arms. Lowering is controlled by a finger-tip release lever.

Standard models can be furnished in capacities from 2,000 to 10,000 lb. Unit illustrated has a fifth wheel steer arrangement to increase maneuverability.

Lyon-Raymond Corp., 14463 Madison St., Greene, N. Y.

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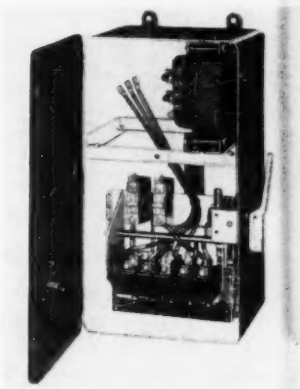
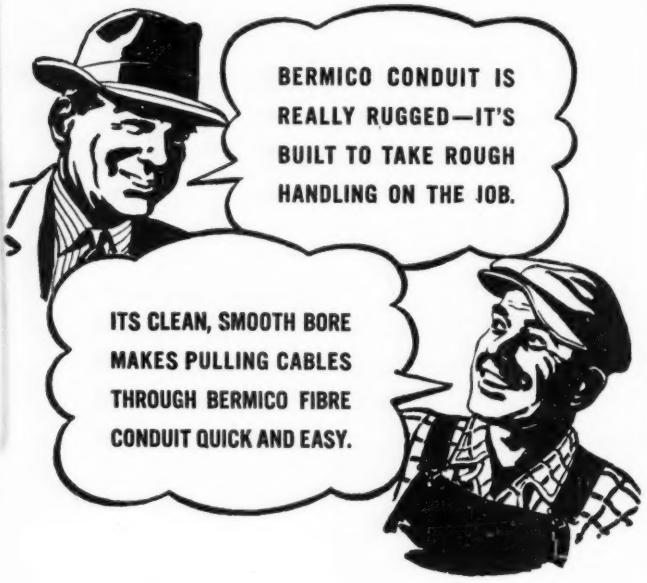


Autotransformer Starter

A LINE OF MANUAL, autotransformer-type starters for squirrel-cage motors comes in two forms: Form T, with air-break contacts, and Form X with oil-immersed contacts. The air-break form can be converted to oil-immersed by adding a standard oil tank that is supported beneath the switch.

A time-delay under-voltage release is standard on the largest or Size D starter and can be supplied as an optional feature on Sizes A, B, and C starters. These starters have an adjustable time-delay mechanism (0 to

BERMICO* FIBRE CONDUIT


BERMICO CONDUIT IS REALLY RUGGED—IT'S BUILT TO TAKE ROUGH HANDLING ON THE JOB.
ITS CLEAN, SMOOTH BORE MAKES PULLING CABLES THROUGH BERMICO FIBRE CONDUIT QUICK AND EASY.

distributed by
WESTINGHOUSE ELECTRIC SUPPLY COMPANY
Offices in all leading cities

BERMICO FIBRE CONDUIT—A PRODUCT OF BROWN COMPANY

15 sec) for controlling the length of the accelerating period before switching the motor from starting to running taps. All starters have two automatic reset overload relays.

The starter is available in four sizes from 5 hp, 220/440/550 v, to 250 hp, 440/550 v, for 25, 50, and 60 cycles.

Allen-Bradley Co, Milwaukee, Wis.

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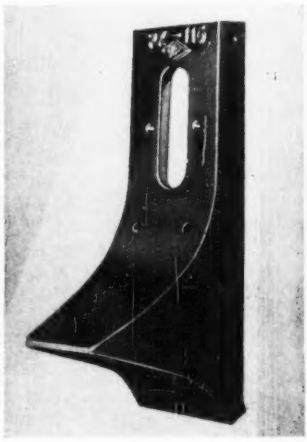


Spur Arm Gain

DESIGNED as a unit device for supporting round arms on H-frame structures is the PX 115 gain for round crossarms. It serves both as a support and a transition piece between the cross arm and the pole, accommodating arms from 6½ to 12½ in. diam.

The forward side of the gain is reported to provide a broad shelf on which the arm bears. Pole side has a long heel with a wide bearing surface on which four spurs are superimposed.

MORE NEW EQUIPMENT

Just Received

Appearing Next Issue

SWITCH-OPERATING MECHANISM
One-hand operation of outdoor disconnecting switches

CONTROL CENTERS
Plug-in type disconnects on line side of motor starter unit

PULL-SWIVEL
Turns freely at both ends to prevent twisting around messenger

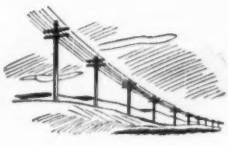
COMBINATION STARTER
Interlock prevents opening starter door when breaker is "on"

STREET LIGHTING TRANSFORMERS
Pole mounting and vault types for series circuits

REGISTER CHECKER
Watthour meter registers checked in a matter of seconds

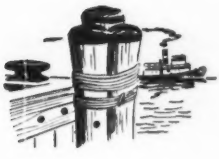
Let's Check The Proved Facts About Wood Preservation!

The proved *facts are simple . . . and well-established.*



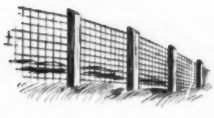
THE FIRST PROVED FACT is that Coal-tar Creosote is the only wood preservative that has proved successful for more than 100 years under practically all conditions.

THE SECOND PROVED FACT is that Coal-tar Creosote, properly applied, makes wood last 3 to 5 times longer. Its deep penetration under pressure protects wood from rot, termites, marine borers, and all other wood-destroying organisms.

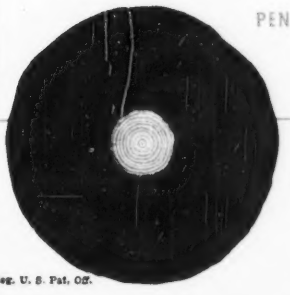


THE THIRD PROVED FACT is that Coal-tar Creosote is the most widely used, and most universally preferred, wood preservative in the world.

You can be *sure* you're safe when you hold to these proved facts. If any other method of wood preservation should ever prove better, you can be certain that Barrett will be among the first to sponsor it. Until then, follow the proved facts—protect your lumber with Barrett* Coal-tar Creosote. Our half-century of wood preserving experience is the basis for this advice.



PENETRATES TO THE HEARTWOOD . . . PRESERVES . . . PROTECTS



THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

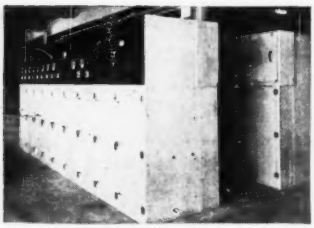
Barrett*

*Reg. U. S. Pat. Off.

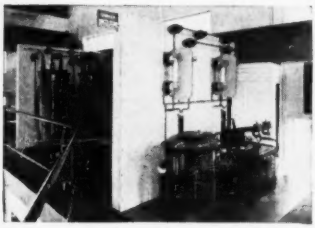
WHY STATION EXPANSION PROGRESSES FASTER . . . COSTS LESS

with Trancell Materials

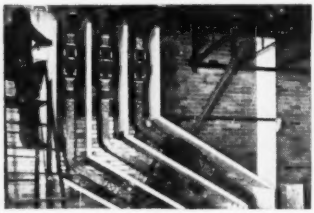
If you're planning to expand your power stations or substation facilities, do what many leading power companies have already done . . . make your station change-overs with Johns-Manville Trancell Materials.



They're safe—fireproof . . . have low heat conductivity . . . adequately isolate high-voltage apparatus.

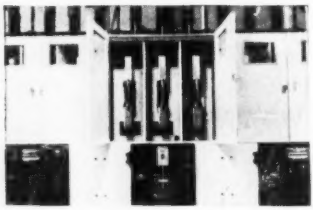


They're neat—make clean, flush-type housings, panels, doors, and partitions.



They're handy—easily cut and drilled on the job, or furnished cut to your specifications.

They're durable—rotproof and rustproof . . . will last for years. Require a minimum of maintenance.



They're economical—light, easy to handle and assemble. Have excellent re-use value.

—for all high voltage power equipment enclosures—Johns-Manville Trancell Materials are made in many sizes and types. Recommended for transformer and switch gear housings and partitions; bus bar enclosures and other services. For further information write to Johns-Manville, Box 290, New York 16, New York.

Johns-Manville

TRANCELL

an asbestos product for housing electrical equipment

Tendency to overturn and slot down the pole is said to be minimized by this design. Arms can be ordered predrilled and creosoted after drilling since the through bolt always can be put through the diametric center of the cross arm.

The gain is a malleable iron casting, hot dip galvanized. Weight is 5 lb.

Malleable Iron Fittings Co, Pole Hardware Dept, Branford, Conn.

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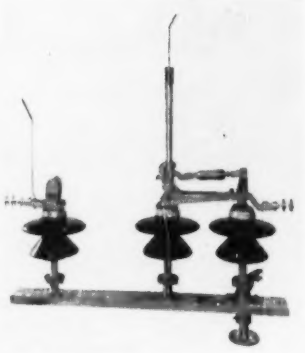


Disconnecting Switch

A NEW LINE of braidless disconnecting switches for 7.5 to 69-kv outdoor service has been announced as a rating extension of the high voltage (115, 161, and 230 kv) units previously available.

Perforations Available

Rows of perforations can be furnished in linoleum, masonite and other panel material supplied for control and dispatchers' boards. Plants, substations, lines, breakers and switches may be designated by colored lines and blocks on the panels. In the holes pegs of various colors and sizes are inserted or removed to indicate operating conditions of equipment.

Holes can be furnished any size but are usually $\frac{3}{16}$ in. or $\frac{1}{8}$ in. diam on $\frac{1}{2}$ in. or $\frac{5}{8}$ in. centers and in straight rows. Panel material is usually $\frac{1}{8}$ in. thick.

(Furnishing of perforations is a service available. Although not an item of new equipment, this service is listed only because it has specific and immediate interest for electric utilities.—EDITORS)

Harrington and King Perforating Co, 5635 Fillmore St, Chicago 44, Ill.

PLEXIGLAS

Gives You Quality Lighting

Coffer lighting panels of white translucent PLEXIGLAS *provide excellent diffused lighting and blend perfectly with their surroundings in the reception room of Associated Fur Manufacturers, Inc., New York City. Fabrication by Steiner Plastics Manufacturing Company, Long Island City, N. Y. Room designed and decorated by Ben Glick and Paul Schulke, Inc., New York City.*

No Glare—No Eyestrain

Here's an end to wasteful, eyestraining "squirt" lighting. PLEXIGLAS panels diffuse the *full* output of the lighting source—give you pure illumination without glare.

No other light-diffusing material brings you the *combined* advantages of PLEXIGLAS acrylic plastic. White translucent PLEXIGLAS absorbs almost no light, yet banishes all glare. Its light weight and strength (many times that of glass) permit safe, easy mounting—even wall-to-wall—with fewer and less expensive supports. Resistance to breakage and discoloration from fluorescent lights cuts maintenance costs to a minimum. Availability in big panels makes PLEXIGLAS a most practical material for large-size lighting fixtures. And because of its resistance to weather, PLEXIGLAS is an ideal material for outdoor applications, too.

PLEXIGLAS is furnished in a wide range of translucencies, plain or patterned. And PLEXIGLAS is easy to form with inexpensive molds. For *quality* wall-to-wall lighting, coffer lighting, fluorescent light fixtures or exterior lighting, send for full information and samples of PLEXIGLAS today.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

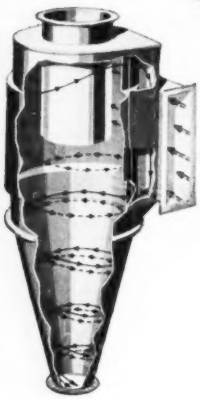
Representatives in principal foreign countries

PLEXIGLAS *is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries.*

Canadian Distributor: Crystal Glass & Plastics, Ltd., 282 St. Helens Avenue, Toronto, Ont.

Minutely precise planning

is vital in COLLECTING



Butterfly net promises to catch everything are unrealistic in trapping fines, ultra-fine and finer-than-that in fly-ash particles. But Buell adjusts its equipment *and your costs* to do a maximum job where results are tangible. No guesswork, no overall assumptions; but a special laboratory analysis of your dust into fractions of different micron-size grading—and a guaranteed performance on each fraction . . . Scientifically arrived-at assurance of potential results is a fundamental part of Buell's engineering service. It is freely available, with no obligation whatsoever. Bring us your problems . . . or, as a preliminary, let us send you 'Engineered Efficiency in Dust Collection'. Write: Buell Engineering Company, 70 Pine Street, Suite 5050, New York 5, New York.

buell

Engineered Efficiency in
DUST COLLECTION

Manufacturing in the United States and Canada for shipment throughout North and South America.

Designated Type RF, the new switch features silver-to-silver line pressure contacts, a simplified operating mechanism, and complete elimination of current-carrying braids.

On the hinge end of the switch, the silver surface of the movable blade engages the silver surface of a U-shaped clip backed by adjustable stainless steel compression springs. Blade operating mechanism has no cams, and anti-friction bearings are reportedly used on all main moving parts. Further details appear in Bulletin GEA-4980.

General Electric Co, Apparatus Dept, Schenectady 5, N. Y.

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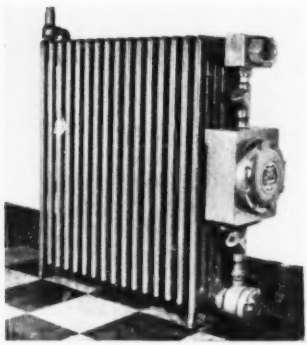


ELECTRICALLY HEATED RADIATOR—A non-inflammable heat transfer liquid conducts heat from the immersion heater to surfaces of an electrically heated radiator. The radiators are reported to be designed for use in locations where inflammable gases, liquids, or dusts are present. They are tested at 120 psi. Heating capacity is 20,200 Btu per hr (6 kw) and heater can be connected for 220/230 v 1- or 3-ph, or 440/460 v 1-ph operation.

L. R. Ward Co, 2711 Commerce St, Dallas, Tex.

MORE NEW PRODUCTS
about which you should know

INDUSTRIAL DEVICES, INC, EDGEWATER, N. J., is offering a general-purpose **volt-ampere tester,** Model 900, that plugs in between line and connection cord to provide simultaneous voltage and amperage readings directly off two dials. . . . HUBBARD SPOOL CO, CHICAGO, ILL., is marketing plastic **spools** for wire storage and shipping that will serve to identify brands by means of the spool color.

STEVENS MFG CO, INC, MANSFIELD, OHIO, is making a positive-operating bimetal **thermostat** for controlling low-wattage circuits; the Type R thermostats are furnished manually adjustable or pre-set. . . AMPLEX CORP, 111 WATER

BOTH CARRY 390 AMPS.

BUT ROCKBESTOS A.V.C.® IS 43% SMALLER

With higher-rated A.V.C. and a 390 ampere load INSTALLED COSTS ARE LOWER*—

- you use a 400 MCM cable *not* 700 MCM
- you use 3″ conduit *not* 3½″
- you use *smaller* fittings and lugs
- you have *lower labor costs* because smaller, lighter cable and conduit are quicker and easier to handle.

Size for size A. V. C. has a HIGHER AMPERE RATING

. . . YOUR BEST BUY

Permanently-insulated Rockbestos A.V.C. can save you money. Write for the booklet "Cut Current Carrying Costs."

*Comparison with Type RH based on Chapter X—National Electrical Code, 40°C-104°F Ambient

ROCKBESTOS A.V.C.

ROCKBESTOS PRODUCTS CORPORATION
New Haven 4, Connecticut
NEW YORK • CLEVELAND • DETROIT • CHICAGO • PITTSBURGH
ST. LOUIS • LOS ANGELES • OAKLAND, CAL.

Case History*

of

Untreated versus Treated Poles

1925 **1946**

51 Untreated Poles Placed . . . 19 Poles Still Serviceable

607 Treated Poles Placed . . . 600 Poles Still Serviceable

AND *Creosote*
MADE THE DIFFERENCE!

In 1946, after 21 years in line—600 out of 607 Pressure-Creosoted Poles were still serviceable. And of the 7 poles no longer in service, 5 had been removed because of a grade crossing clearance—2 because of an accident. *Not a single one* of the 607 poles had been removed because of deterioration due to treatment or preservative failure—a 100% record for creosote.

And when it comes to creosote, you get the best possible delivery service from Koppers. With 14 creosote-producing plants—with 4 large storage plants—Koppers can supply you with creosote *where* you need it—*when* you need it.

Koppers is the nation's largest distributor of creosote. So remember—you can always count on Koppers to help you maintain your production schedules.

KOPPERS COMPANY, INC. · Pittsburgh 19, Pa.

*Proceedings of the American Wood Preservers' Association—1947.

All Standard Specifications
For All Types of Wood Preservation

KOPPERS CREOSOTE...*to be sure*!

ST, BROOKLYN 1, N. Y., is manufacturing a new 500-w sealed-beam industrial **infrared lamp**; also other lamps from 125 w and up.

STANDARD SAFETY EQUIPMENT CO, 232 W. ONTARIO ST, CHICAGO 10, ILL., has a fluorescent **tube disposal unit** that collects the glass fragments in a disposable container and washes away the beryllium with a constant flow of water. . . . CARPENTER MFG CO, MASTER LIGHT BLDG, BOSTON 45, MASS., offers the All-in-Head **emergency light** for use with a dry battery in the event of light failure.

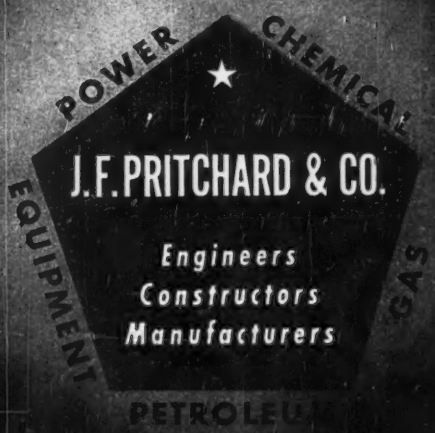
ADAMS ENGINEERING CO, 1969 E. 119TH ST, CLEVELAND, OHIO, is making a drag **brake winch** for loads to 9 tons featuring a flush type cable clamp to give an even layer of cable the length of the drum. . . . GENERAL ELECTRIC CO, SCHENECTADY 5, N. Y., has announced a recording **spectroradiometer** to aid in the study, standardization, manufacture, and control of fluorescent lamps and light emission from electric arc discharge lamps.

BRENTON EQUIPMENT CO, 489 BRYANT ST, SAN FRANCISCO, CAL., offers **"Barricade Tape"** in various color combinations for marking off areas where energized equipment is in service, or other hazardous conditions exist. . . . PRECISION EQUIPMENT CO, 3710 MILWAUKEE AVE, CHICAGO, ILL., is producing an all-steel industrial **shelving** installed without nuts or bolts, that is claimed to have a capacity of one ton per section when fully reinforced.

EASTMAN KODAK CO, ROCHESTER 4, N. Y., is manufacturing a direct-positive **film** for reproducing engineering drawings, maps, and physical surveys; called Autopositive film, it can be handled in normal room light. . . . SPERRY PRODUCTS INC, DANBURY, CONN., has introduced a Type UR, Style 50E351, **Reflectoscope** for testing metals and welds; details in Bulletin 50-105.

SILENT HOIST & CRANE CO, INC, BROOKLYN 20, N. Y., is marketing a 5-ton front boom **crane** with four forward speeds up to 14 mph. . . . LYON-RAYMOND CORP, 14458 MADISON ST, GRELNE, N. Y., offers a hydraulic elevating **positioner** of 1,000 lb capacity for welding assembly, etc.

CALF-TERIA SALES, INC, FORT WAYNE 3, IND., has announced a portable 65-amp, 110-v **welder** intended for the farm market. . . . AMERICAN-LAFRANCE-FOAMITE CORP, ELMIRA, N. Y., has a 2½-gal **fire extinguisher**, Model 5F-V-1, for fire protection of heavy vehicles.



SYMBOL OF ASSURANCE

J.F. Pritchard & Co.

ENGINEERS • CONSTRUCTORS • MANUFACTURERS
for the CHEMICAL, PETROLEUM, GAS & POWER industries

908 Grand Ave. • Kansas City, Missouri
Offices in Principal Cities from Coast to Coast

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

PROOF

FROM

NORTH CAROLINA

"so far as I am concerned, the 'CSP' is the only transformer"

What backs up this statement by the manager of a southern co-operative, about the "CSP"* Completely Self-Protecting transformer?

In August, 1947, the most severe wind and lightning storm in his long experience lashed the area served by his company. Five breaks in the line were reported, plus two breaks in the neutral. Service trucks were rushed out—and, naturally, they carried replacement transformers.

But not one "CSP" transformer had failed!

This striking proof of the lightning protection built into "CSP" transformers is one reason why 1,050 transformers in the 520 miles of line in this system are "CSP" units. And why only 50 are conventional type.

One thing is sure: the built-in lightning protection of "CSP" transformers lowers maintenance costs. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-70525

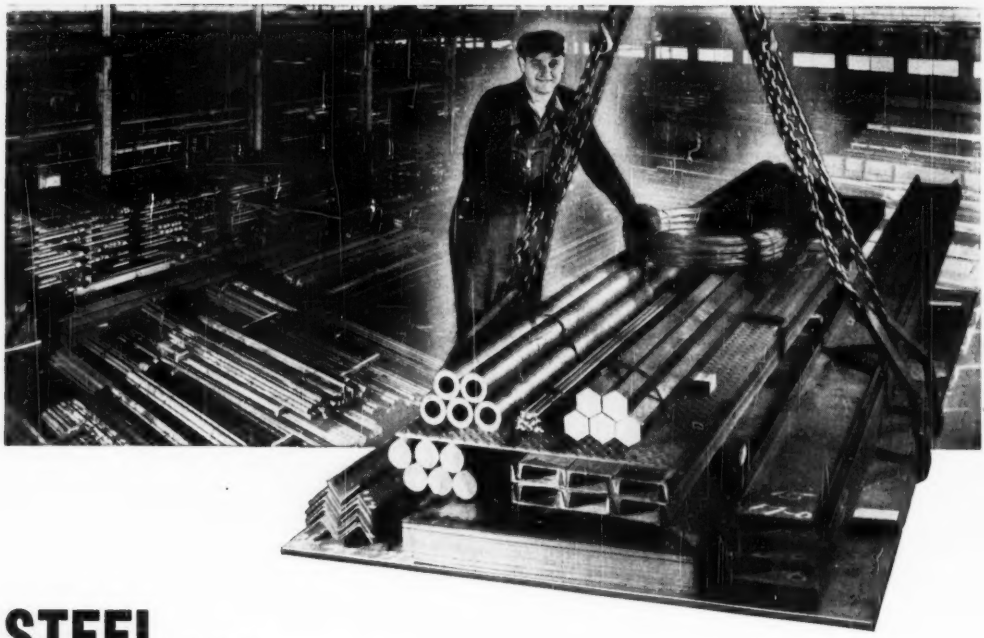
**Trademark—Reg. U. S. Pat. Off.*

HERE'S PROOF FROM U. S. A.—Thirty case histories of Completely Self-Protecting transformers, with names, dates, places, facts and figures. Get your copy of B-4248.

Call the Westinghouse Salesman

Westinghouse "CSP" TRANSFORMERS

SINGLE PHASE **THREE PHASE** **BANKED SECONDARY**



STEEL . . .

for Every Utility Need

Shipped Quickly from Ryerson Stocks

Call Ryerson for the steel you need and you'll find we're always on the job.

Every day, electric power and light companies from coast to coast are being expertly served by the network of thirteen great Ryerson plants. Each plant has large and diversified stocks. Each plant is equipped to accurately cut or otherwise prepare your steel to exact specifications.

Under the Ryerson simplified purchasing system you save time. One order and one invoice quickly cover a whole group of steel requirements. Specialists, whose recommendations are backed by more than a century of Ryerson steel-service experience, will gladly assist you on any problem of application or fabrication.

For highest quality carbon, stainless, or alloy steels—any kind, shape, or size—contact your nearest Ryerson Plant.

PRINCIPAL PRODUCTS

BARS—Carbon & alloy, hot rolled & cold finished
SHAFTING—Cold fin., ground & polished, etc.
STRUCTURALS—Channels, angles, beams, etc.
TUBING — Seamless & welded mechanical & boiler
STAINLESS—Allegheny plates, sheets, bars, tubes
PLATES — Sheared & U. M., Inland 4-Way Floor Plate
SHEETS—Hot & cold rolled, many types
MACHINERY & TOOLS —For metal fabrication

RYERSON CERTIFIED STEELS

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • DETROIT • CINCINNATI
CLEVELAND • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO

NEWS ABOUT PEOPLE

Mississippi Power Co Directors Elect Muths, King Vice-Presidents

SHERMAN L. MUTHS

DANA G. KING

Sherman L. Muths and Dana G. King have been elected vice-presidents of Mississippi Power Co.

King, who has been assistant to the president, and Muths, who has been operating manager, have been with the company since its first year of operation, 1925. They have been directors since 1942.

Muths, born in Mobile, was graduated from Alabama Polytechnic Institute with a bachelor of science degree in electrical engineering in 1922.

King, a native of Cherokee, Ia., has been in Mississippi since 1912. He received his bachelor of science degree in electrical engineering from Mississippi State College in 1924.

•

E. G. Rash, manager of the Wasco Public Utility District, The Dalles, Ore., will succeed **John C. Hoge** as manager of the Grays Harbor PUD at Aberdeen, Wash. Hoge will become city utilities manager of Fayette, La.

William W. Martenis has been appointed manager of sales engineering by Minneapolis-Honeywell Regulator Co. In the newly created post Martenis will assist in planning specifications, approve new developments, and coordinate activity between the sales and engineering departments. He joined Honeywell in 1931 in the engineering test department and later became chief designer and chief application engineer.

Commonwealth Services Fills Engineering Posts

New engineering executive appointments have been made by Commonwealth Services, Inc, Jackson, Mich., successor to Commonwealth & Southern Corp (N. Y.).

W. R. Brownlee has been named supervisor of power systems engineering, J. N. Gosinski staff engineer, and H. R. Wall supervisor of distribution systems engineering.

Brownlee has been with the Commonwealth system for more than 20 years. His duties have included load division and stability analysis, protective relaying applications, operating engineering, and interconnection studies. In his new position he will direct power system engineering studies. Brownlee has been chairman of the American Institute of Electrical Engineers' Relay Committee and is vice-chairman of its Power Coordinating Committee.

Gosinski will conduct load and utilization studies and economic analyses. He has been with the organization since 1923, most recently responsible for engineering studies relating to distribution system planning and operation.

Wall came to Commonwealth 13 years ago from Cleveland Electric Illuminating Co. He has been engaged in station design, technical applications and investigations, system protection, operating problems, and planning.

Westinghouse Announces Engineering Appointments

Charles F. Wagner, manager of the central station section of the Westinghouse Electric Corp industry engineering department for the last eight years, has been appointed consulting engineer in the central station and power fields.

Wagner will be succeeded by A. A. Johnson, who has been handling consulting engineering problems for electric utilities and manufacturing plants. In his new position Johnson will coordinate the company's engineering activities on problems of generation, transmission, distribution, and system protection for utilities and large industrial plants.

Wagner has been with Westinghouse since 1918. From the research engineering department he was transferred to the consulting staff of Dr C. L. Fortescue in 1923. After a short period back in the research laboratories he went to the central station section in 1934. In 1938 he became consulting transmission engineer and in 1941 manager of the central station section.

A fellow of the American Institute of Electrical Engineers, Wagner has been chairman of its Transmission and Distribution Committee and its Publication Committee. He is the author of more than 60 technical papers, has about 30 patents to his credit, and has represented the United States with various committees and at conferences abroad. He has been awarded the honorary degree of doctor of engineering by Illinois Institute of Technology and the Westinghouse Order of Merit.

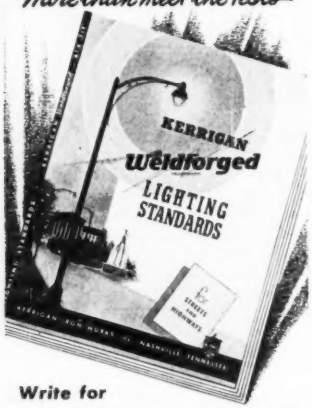
A member of AIEE, Johnson spent 11 years with Consolidated Edison Co of New York before joining Westinghouse's central station section in 1941. He has taught at Pratt Institute, Brooklyn, and is now a Westinghouse lecturer with the graduate program of the University of Pittsburgh.

•

P. R. Lyons, Ohio district manager for Hanson-Van Winkle-Munning Co since 1931, has been appointed manager of electrical sales for the company with headquarters in Matawan, N. J. He will coordinate sales of motor generator sets, rectifiers, tank rheostats, and other electrical products. Earlier he had been in electrical work with Illi-

For Beautiful
Well Lighted
STREETS

KERRIGAN
STANDARDS
More than meet the Tests



Write for

Your FREE copy now!

(on your letterhead, please).

Kerrigan Weldforged Lighting Standards are designed and engineered to conform to I.E.S. Street Lighting Codes, and meet the highest engineering standards for highway and street lighting. Whatever special lighting problems you may have, KERRIGAN can help you solve them. Check the Kerrigan specification list below to see what Kerrigan Weldforged Standards offer you, then write for our Lighting Standards booklet A1A 31F for detailed specifications and catalog information.

- √ 20, 25, 30 foot shafts to conform to I.E.S. recommendations; 4, 6, 8, 10, 12 and 15 foot mast arms to conform to I.E.S. recommendations.
- √ Continuous Tapered Octagon shafts from open hearth steel.
- √ Heavy Steel construction for maximum strength.
- √ Detachable mast arms, brackets, and transformer bases for easy installation and maintenance.
- √ Ornamental scroll braces for beauty and strength.
- √ Mechanically primed at the factory with red oxide, inside and out, for longer life. Finish coat can be easily applied after standards are in place.
- √ Special designs to meet ANY and ALL Special Requirements.

Consult the
KERRIGAN ENGINEERING DEPT.
concerning your street lighting problems

— Write —

KERRIGAN IRON WORKS, Inc.
General Sales Office:
274 MADISON AVENUE, N. Y. C.

nois Steel Co and the U. S. Army Engineers Corps and had specialized in conveyor sales for A. P. Munning & Co, later merged with Hanson & Van Winkle Co.

•

New Assignments

Mason C. Albrittain has been appointed general manager of the industrial and commercial department of Consolidated Gas, Electric Light & Power Co of Baltimore. With the utility for 25 years, most recently he has been assistant general manager of the department. Albrittain succeeds **Richard H. Tillman,** who retired recently after 40 years' service . . . **Robert M. Chase** has been appointed manager of the Foster Street plant of Telechron, Inc, Worcester, Mass., in addition to his duties as manager of the company's Main Street plant there.

•

Sanford K. Fosholt has been appointed chief engineer of Stanley Engineering Co, Muscatine, Ia., and **Franklin M. Swengel** has been named head of the mechanical section. Fosholt, with Stanley since 1938, has served as electrical engineer and head of the mechanical section. Swengel had been with Sargent & Lundy of Chicago as a senior mechanical engineer since 1947.

Thomas G. Allan has been appointed manager of the rural service and dealer sections of West Penn Power Co, in a reorganization adding the rural service responsibility, formerly held by the late W. W. Carson, to Allan's present duties as dealer manager. Allan started as a salesman with West Penn Appliance Co in 1931 when the utility was in merchandising. When the power company dealer section was formed in 1938, he became dealer representative in the Kittanning area and, in 1945, manager of the section.

Col Donald S. Burns has been appointed U. S. Army Corps of Engineers district engineer at Portland, Ore., succeeding Lt Col Donald A. Elliget, acting Portland district engineer since the promotion of Col Orville E. Walsh to the post of North Pacific division engineer. Colonel Burns was chief of the engineering division, military construction, Office of the Chief of Engineers, before going to Portland.

H. G. Blakeslee, vice-president and general manager, Cory Corp, Chicago, has been elected chairman of the Commercial Cooking Equipment Section of the National Electrical Manufacturers Association.

GE Makes Appointments in Apparatus Department

Six executives of General Electric Co's apparatus department have been named to new positions.

Neil Currie, Jr. has been appointed administrative assistant to the general manager. He has been manager of manufacturing since 1944. Ernest E. Johnson, manager of engineering for the department since 1945, has been made manager of engineering for the large apparatus divisions.

Other advancements include: Carl A. Salmonsen from manager, aircraft gas turbine divisions, to manager of manufacturing, large apparatus divisions; Byron A. Case, from assistant to manager of engineering to manager of engineering, small apparatus divisions; Frank T. Lewis from manager of manufacturing, aeronautic, and ordnance systems divisions, to manager of manufacturing, small apparatus divisions; Clarence H. Linder from assistant manager of manufacturing to assistant to the general manager.

Currie joined GE in 1908 and in early years served in the power motor engineering department as assistant engineer, engineer, and managing engineer. In 1929 he became manager of the Philadelphia Works; in 1936 manager of the Fort Wayne, Ind., Works; and in 1939 assistant to the vice-president in charge of manufacturing.

Johnson, who went to GE in 1922, has served in personnel, generator voltage regulator engineering, and aeronautics engineering.

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F. A. Hutchins, for 43 years a member of the motor engineering division, River Works, General Electric Co, Lynn, Mass., has retired.

George L. Sutherland, manager of the substation operation department of Consolidated Edison Co of New York, has retired after 21 years with the company. Among positions he has held are senior engineer in the electrical engineering division of Stone & Webster, Boston; electrical engineer of United Electric Light & Power Co; chief electrical engineer of Duquesne Light Co; general superintendent of New York & Queens Electric Light & Power Co; and assistant manager of the outside plant construction department and general stores manager of the purchasing stores department of Con Ed. He was U. S. technical advisor on proposed interational standards for electrical generation and distribution equipment at the International Electro-Technical Commission at Stresa, Italy, last summer. He has served as

chairman of the sectional committee on power switchgear of the American Standards Association; chairman of the joint committee on power circuit breakers of Edison Electric Institute, Association of Edison Illuminating Companies, and the National Electrical Manufacturers Association; and member of the board of examiners of the American Institute of Electrical Engineers.

OBITUARY

L. E. Bogen, former engineer in the motor and generator section of Allis-Chalmers Manufacturing Co's electrical department, died Dec 3 in Cincinnati. One of the pioneers in the electrical industry, Bogen specialized in waterwheel generator and synchronous condenser applications and participated in many early hydroelectric installations. He taught physics at Ohio Mechanics Institute and the University of Cincinnati before joining Bullock Electric Manufacturing Co, Cincinnati, in 1901. After Allis-Chalmers acquired Bullock, Bogen transferred to the Milwaukee works. He returned in 1947.

William H. Sharpe, 50, sales service manager of Rome Cable Corp, Rome, N. Y., died suddenly at his home Nov 16. Sharpe joined Rome Cable in 1936, the company's first year of operation, after working for Rome Wire Co at its Buffalo plant and for General Cable Corp.

Percy C. Drake, 55, treasurer of Quebec Hydro-Electric Commission, died Nov 26 in Buckingham, Que. Drake joined the former Montreal Light, Heat & Power Co in 1906 as an office boy and in 1930 became treasurer, a position he retained with the Hydro-Electric Commission. In 1933 he also was made treasurer of Beauharnois Light, Heat & Power Co.

James H. Wood, 79, of Dover, N. H., from 1903 to 1907 president of the Twin State Gas & Electric Co, now Public Service Co of New Hampshire, died Nov 21. Wood was for many years a consulting engineer with Stone & Webster, Boston.

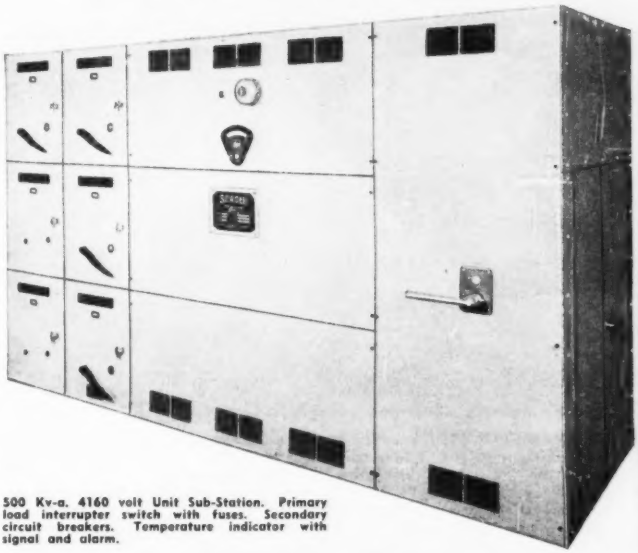
Joseph P. Everett, 64, former public relations representative for Toledo Edison Co, died Nov 24 after a long illness. He was with Toledo Edison 22 years until his retirement two years ago.

John Frederick Wessel, retired utility executive, died Dec 8 in Nashville, Tenn. Until his retirement 15 years ago Wessel served as managing director of utility properties, including North American Co and Electric Bond & Share Co.

Power Centers

with

SORGEL AIR-COOLED TRANSFORMERS



500 Kv-a. 4160 volt Unit Sub-Station. Primary load interrupter switch with fuses. Secondary circuit breakers. Temperature indicator with signal and alarm.

Unit Sub-Stations

Complete with primary switch gear, metering, and secondary circuit breakers, all safely encased in steel.

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Constructed to meet any specifications and requirements.

Can be installed anywhere inside of buildings at load centers. Big savings in distribution and installation costs.

Also a complete line of other *air-cooled, dry-type* transformers.

¼ to 2000 Kv-a. Single phase and poly-phase.

All voltages—115 to 15,000 volts, and other special voltages.

Sales Engineers in Principal Cities

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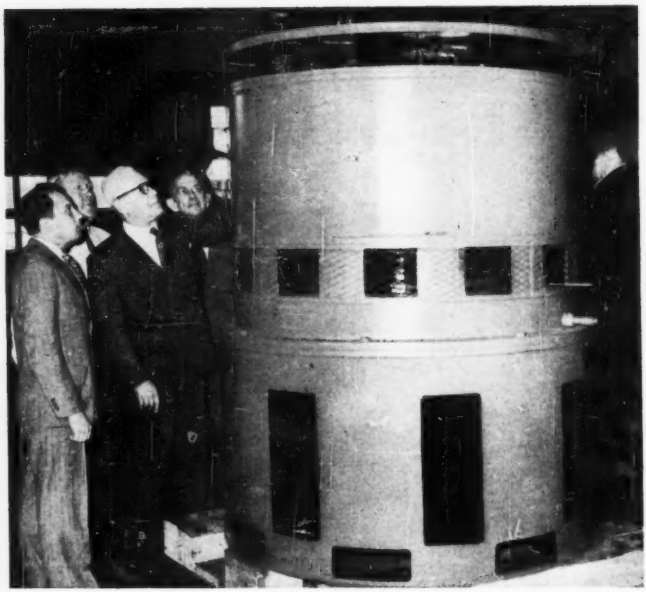
MANUFACTURERS and MARKETS



FIRST ADJUSTABLE-SPEED vertical synchronous motor-magnetic drive unit built for direct coupling to its pump is inspected in Electric Machinery Manufacturing Co shops by company and City of Philadelphia engineers. Philadelphia has ordered four for its storm-water-pumping system. Left to right are T. S. Kasanowski, electrical engineer for the city; Frank Anderson, manager of the company's test division; Louis Kusner, city associate engineer of electrical design; and Rupert Early, company electrical design engineer

Dr Boveri Visits U. S. to Get Materials and Orders; Cleveland Prices Still OK

In this country last week for the avowed purpose of "improving our export position," Dr Walter E. Boveri, chairman of the board of Brown Boveri, Baden, Switzerland, was shopping around for both American orders and American raw materials. He had this to say about business conditions here and abroad:

1. The Marshall Plan is working a hardship on Brown Boveri. Countries getting Marshall dollars can't spend them in Switzerland—a non-Marshall-Plan country.

2. American standardization and mass production methods are forcing Brown Boveri to focus production on large, special machines, where the labor differential in its favor gives it a price advantage in American markets.

3. Boveri reports Brown Boveri is working at ⅓ capacity on the manufacture of small machine motors and generators under 10,000 kw.

4. Order backlog for large, special machines and turbo-generators over 15,000 kw is 2-3 years but decreasing.

5. American electrical sheet steel is better than the European product both in price and quality, but delivery takes so long it is impossible to get a firm contract here.

6. Cost of European steel has come down a little recently, but so has the quality of commonly used types.

Commenting specifically on the order for two 25,000-kw turbo-generators for the City of Cleveland, which Brown Boveri won last year with a bid $400,000 under that of major electrical firms in this country, Boveri said the price quoted then was "a good one." Asked if he would be willing to accept more turbine business today at that price, Boveri said he would take all he could get. With his backlog on big machines lower than a year ago, conditions were more favorable to new turbine business from America, he said.

Boveri observed dryly that he understood his firm's bid of $1,140,000 for the two Cleveland turbo-generators had caused considerable consternation in the City Council until it was learned that Brown Boveri bought more goods (machine tools) in Ohio in a year than the turbines were worth.

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National C of C Offers Pension Plan Check-List

A 19-point check-list has been offered to employers planning pension systems by the United States Chamber of Commerce. Many of the questions raised also would apply to other welfare benefits.

Among the points the Chamber advises employers to study are the pension plan's effect on labor costs; long-term financial obligations involved in back service credits, which should be approved by stockholders; financing and administering of the plan, whether a group individual policy or group annuities purchased through an insurance company, trust fund, or self-insurance; conformity to applicable state and federal regulations; eligibility; effect of severance; and the interval between bargaining dates.

Employers should obtain the best technical advice before setting up a program, the Chamber warned. It also recommended that companies determine whether the plan should be contributory or non-contributory; consider the desirability of refunding; make liabilities definite and clear; set up safeguards if the union participates in administration; and decide whether to make the amount of employee benefits or the amount of employer payments the basis; whether all employees should be included in the same plan; whether benefits should be tied to public pensions; whether benefits should be related to

earnings and length of service: whether retirement should be compulsory; and whether benefits should include disability.

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New Sales Assignments

Electrical manufacturing companies have appointed the following sales representatives:

William Brand & Co, New York, has appointed Mitchell H. Hirsch, C. H. Mitchell Co, 769 Venice Boulevard, Los Angeles, as its sales representative for California.

Curtis Lighting, Inc, Chicago, has named Fred A. Stewart, Philadelphia area representative.

Altec Lansing Corp, Peerless Electrical Products Division, New York, has appointed Sun Radio & Electronics Co, Inc, as exclusive jobber of Peerless transformers in the New York metropolitan area.

W. N. Matthews Corp, St. Louis, has appointed Richard A. Kent Co, 50 Church St, New York 7, sales representative in the New York metropolitan area, New Jersey, and western Connecticut.

Potter & Brumfield, Chicago, has moved its general sales office to Princeton, Ind., and will conduct sales from the manufacturing plant there. Ralph Brengle is general sales manager. John Newman will handle regional sales at the old Chicago office, 549 West Washington Boulevard.

De Laval Steam Turbine Co, Trenton, N. J., has appointed Superheater Co, Ltd, of Montreal, Canada, and the latter's affiliate, Combustion Engineering Corp, Ltd, to sell and service its turbines, pumps, gears, and compressors in Newfoundland, New Brunswick, Nova Scotia, Prince Edward, and Quebec.

Line Material Co, Milwaukee, has opened a new office and warehouse building for its Southwestern branch at 107 Pittsburg St in the Trinity Industrial District of Dallas.

John A. Roebling's Sons Co, Trenton, N. J., has opened a new office and warehouse at 3253 Fredonia Ave, Cincinnati, O. W. K. Hanna, former head of the Pittsburgh branch, will be manager.

Dampney Co of America, Boston, has appointed Industries Service & Equipment Co, 822 West 34th Street, Erie, Pa., as representative in the Counties of Erie, Crawford, and Warren for Dampney protective coatings for maintenance of metal. Industries Service will handle APEXIOR, THUR-MA-LOX, and the new Dampney vinyl and silicone formulations for equipment in power and processing service.

Electronic Instruments, Ltd., Richmond, Surrey, England, has named Herman H. Sticht Co, Inc, 27 Park Place, New York, is sole U. S. representative. The firm will distribute the new 20 Million Megohmmeter, an instrument designed to measure electrical resistance over a range from 300,000 ohms to 20,000,000 megohms.

Graybar Electric Co, New York City, has appointed two new district managers. R. W. Kimberlin will succeed J. P. Carson, retiring, as San Francisco district manager, and C. S. Powell will replace Kimberlin as St. Louis district manager.

DO YOU KNOW,
MR. UTILITY OPERATOR THAT

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Can help you anticipate an increased power load due to an approaching cold wave with its accompanying high winds

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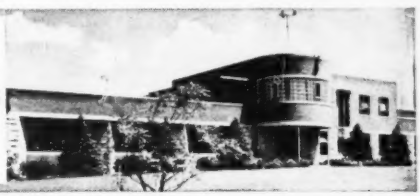

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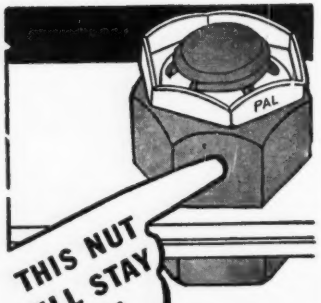
Bendix AVIATION CORPORATION

Export Sales: Bendix International Division, 72 Fifth Avenue, New York 11, N.Y.



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PALNUT Self-Locking Nuts are inexpensive single thread, tempered spring steel locknuts — easily, speedily spun on top of regular nuts with the fingers, locked tight with a wrench.

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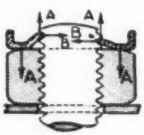
Arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt threads and downward on the regular nut (A-A), securely locking both.



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Used on transformers, switches, disconnects, etc. Keep terminals tight, eliminate spring washers, assure full conductivity. Plain, Parkerized or Duronze according to needs.

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NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Arizona—Bureau Reclamation, Dpt. Interior, Phoenix, constr. Coolidge substation, approx. 1½ mi. north of Coolidge, Davis Damp Proj. Spec. 2849. L. N. McClellan, Bldg. 1-A, Denver Federal Center, Denver, Colo., ch. engr.

Arkansas—U. S. Eng., 300 Broadway, furnishing nine lighting distributing center, complete with panel boards, four panel enclosing cabinets, lighting transformer, f.o.b. railroad cars, Cotter, Bull Shoals Dam, Inv. No. 03-050-50-47.

Calif., Agnew—State Div. Architecture, P. Wks. Bldg., Sacramento, electrical distr. sys. at Agnews State Hospital, Anson Boyd, Sacramento, state archt.

Del., Milford—City, municipal power plant, **$100,000.** R. O. Vannort, 513 S. Tryon St., Charlotte, N. C., consult. engr.

Idaho—Bureau Reclamation, Anderson Dam, installing electrical and mechanical equipment, Anderson Ranch Power Plant, switchyard and outlet works, Boise Proj., south fork of Boise River about 30 mi. northeast of Mountain Home, Spec. 2852. L. N. McClellan, Bldg. 1-A, Denver Federal Center, Denver, Colo., ch. engr.

Indiana—Bartholomew County Rural Electric Membership Corp., Columbus, 13 mi. rural distr. lines, and 5.75 mi. conversion, Bartholomew Co. Phillip L. Burns, 630 Davenport Bank Bldg., Davenport, Ia., consult. engr.

Kansas—Victory Electric Co-operative, Hutchinson, c. rural distr. lines, Sect. F. in Ford Co. **$200,000.** Frank Horton & Co., Lamar, consult. engrs.

Kentucky—East Kentucky Rural Electric Co-operative Corp., Danville, 597 mi. 69 kw. transmission lines; 40,000 kw. steam plant at Ford. **$10,265,000.**

Louisiana—Louisiana Rural Electric Co-operative, Alexandria, 120 mi. rural dist. and transmission lines, 8.5 mi. 34.5 KV transmission lines, a 2000 KVA substation in Rapides, Avoyelles, Evangeline, St. Landry and Grant Parishes, $152,000. Plans deposit $10. Freese & Nichols, 407 Daniger Bldg., Fort Worth, Tex., engrs.

Pa., Phila.—Dpt. P. Wks., Thomas Buckley, dir., City Hall Annex, high power lightining sys. on 10 mi. highways. **$300,000.**

Texas—Karnes Electric Co-operative, Inc., Karnes City, 65 mi. rural distr. lines and headquarters facilities, Karnes Co. **$212,000.**

Va., Charlottesville—State of Virginia, Richmond, heating plant, etc. at University of Virginia. **$560,500.**

Wyoming—Bureau Reclamation, Dpt Interior, Cody, Boysen-Thermopolis 115-kilovolt transmission line, Transmission Division, Missouri River Basin Proj., near Thermopolis, Spec. 2856. L. N. McClellan, Bldg. 1-A, Denver Federal Center, Denver, Colo., ch. engr.

Low Bidders & Contracts Awarded

Kansas—Co-operative Electric Power & Light Co., Iola, 161.06 mi. rural distr. lines and 54.5 mi. of conversion, Coffey, Anderson, Woodson, Allen and Wilson Counties, to James H. Drew Corp., architects & Builders Bldg., Indianapolis, Ind., **$208,940.** Bids 11/8.

Missouri—Northeast Missouri Electric Power Co-operative, Palmyra, constructing 40 mi. rural distr. lines and 2 substations, Pike and Ralls Counties, to Cator Constr. Co., 1016 Baltimore Ave., Kansas City 6, Mo., **$69,266.** Bids 11/4.

Nebraska—Eastern Nebraska Public Power Dist., Syracuse, 26.7 mi. 69 kv. rural distr. lines, Johnson, Nemaha and Richardson Counties, to Illinois-Iowa Constr. Co., Abbingdon, Ill. **$90,749.** Bids 11/28.

New York—Bd. Transportation, 250

Crapo GALVANIZED STEEL STRAND

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EVERY requisite that sound construction needs demand are combined in *Crapo* Galvanized Steel Strand—

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EBASCO specialists study your present system, markets, load growth and customer service requirements. They coordinate the planning of required additions and revisions to the three components of the system — *power supply — transmission — distribution*. They bring a fresh *objective* approach and application of advanced practices to each problem they tackle — along with diversified experience in the development and operation of all types of utility systems and power pools.

EBASCO engineers will develop several alternative plans with comparisons of investments, investment costs, operating costs, evaluated service and other factors. You get a complete report on which management can act with assurance. It advises you on *when*, *what* and *where* to build. *Write for a booklet describing* EBASCO *services and facilities.*

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Rates & Pricing • Research • Sales & Marketing • Taxes • Traffic

Hudson St., New York Zone 13, No. 18, installing signal and telephone equip. for Hillside Ave. extens., west of Parsons Blvd. Station to 184 Pl. Line D, Queens Co., from Watson-Flagg Eng. Co., 140 Cedar St., New York, Zone 6. **$753,947.**

N. Y. Poughkeepsie—Bureau Contracts & Accounts, Albany, Nov. 30, electrical work for rewiring main group, Central Group and Edgewood at Hudson River State Hospital, from Kaplan Electric Co., 128 E. 16 St., New York, and Delta Electric, Inc., 14 Martine Ave., White Plains. **$118,711.**

Oklahoma—Grand River Dam Auth., Vinita, 23 mi. 69,000 volt electric transmission line from Tahlequah to Stilwell, to J. & J. Constr. Co., 1st Natl. Bldg., Oklahoma City, Zone 2. **$151,027.** Est. $160,000. Awarded 11/30. W. R. Holway, 302 E. 18 St., Tulsa, engr.

South Dakota—Spink Electric Assn., Redfield, Nov. 3, rural distr. lines, Spink Co., from Power Eng. Co., Benson Bldg., Sioux City, Ia., **$211,596.** Buell & Winter, Insurance Exchange Bldg., Sioux City, Ia., engrs.

Tenn., Oak Ridge—U. S. Atomic Energy Comn., Oak Ridge, 4th unit gaseous diffusion unit, K-31, to Maxon Constr. Co., Inc., 131 N. Ludlow St., Dayton, O., Approx. **$162,000,000.** Giffels & Vallet, Inc., 1000 Marquette Bldg., Detroit, Mich., archeengr.

Texas—Concho Valley Electric Co-operative, Inc., L. A. Watkins, pres., San Angelo, Nov. 22, 88.3 mi. rural distr. lines and conversion, one 225 kva substation, Tom Green, Concho, Coke and Irion Counties, from Willis & Hinders, P. O. Box 204, Olney, **$79,083.** Est. $100,000.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Ala., Birmingham—Pub. Bldgs. Admin., 18 and F Sts. N. W., Wash. 25, D. C., post office, **$6,600,000.**

La., New Orleans—Pub. Bldgs., Admin., 18 and F Sts., N. W., Wash., 25, D. C., post office, etc., **$14,900,000.**

Md., Baltimore—Pub. Bldgs. Admin., 18 and F Sts. N. W. Wash 25, D. C., federal office bldg. **$8,160,000.**

Md., Bethesda—Eugene B. Casey, Bethesda Ave. and Clarendon Rd., 1,500 unit apartment adjacent to Naval Medical Center, Connecticut Ave. and Jones Bridge. **$10,000,000.** Project subject to zoning clarification. The Casey Eng. Co., c/o owner, engr.

Mich., Detroit—Pub. Bldgs. Admin., 18 and F Sts. N. W., Wash. 25, D. C., post office, North End Station **$165,000;** post office Roosevelt Park Annex **$5,450,000.**

N. Y., Brooklyn—Pub. Bldgs. Admin., 18 and F Sts. N. W., Wash. 25, D. C., courthouse, **$8,570,000;** post office Station E, **$580,000;** post office Station S, **$360,000.**

N. Y., New York—Columbia University, 116 St. and Broadway, 6 story engineering center, W. 125 St. and Riverside Dr. **$5,000,000.**

O., Cleveland—Veterans Admin., Vermont Ave. between H and I Sts. N. W., Wash. 25, D. C., plans by W. R. Talbot, steel c/o owner, 9 story, bsmnt., penthouse, 500-bed brick, steel veterans hospital, incl. 3 wings, 10723 East Blvd. and 10710-10728 Magnolia Dr. **$7,500,000.**

Pa., Phila.—Dpt. Welfare, Harrisburg, construct Eastern Psychiatric Institute, Abbottsford Rd. and Henry Ave. **$4,000,000.**

Tenn., Nashville—Cain-Sloan Co., 5 and Church Sts., plans by Marr & Holman, Stahlman Bldg., department store. **$5,000,000.**

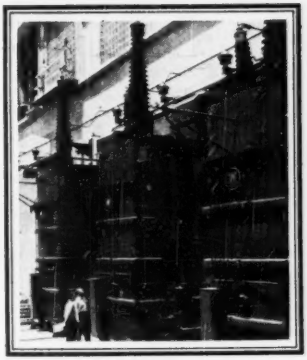
Wis., Union Grove—State Dpt. P. Welfare, Madison, plans by Roger C. Kirchoff, state archt., Madison, receiving bldg. with nursery and isolation ward, **$1,500,000;** custodial and treatment bldg., **$1,000,000;** employee's bldg., **$450,000;** staff residence, **$40,000,** at Southern Colony and Training School.

Low Bidders & Contracts Awarded

Ala., Mobile—Mobile Infirmary, Inc., c/o low bidder, Nov. 29, hospital from Henry C. Beck Co., First National Bank Bldg., Atlanta, Ga., **$3,074,700.**

S. C., Williamston—Textron, Inc., c/o contractor, 160,000 sq. ft. filament rayon weaving plant, to Daniel Constr. Co., Greenville. Approx. **$3,500,000-$4,000,000.**

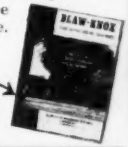
WHY TAKE THAT CHANCE?



There *may* be only one chance in a thousand that *your* big power transformers will ever suffer a fire loss. But it is so simple and inexpensive to have automatic protection against that loss.

Blaw-Knox Automatic Fog Transformer Protection Systems* are electro-thermostatically controlled. When fire danger approaches, they instantly release a cooling, quenching cloud of fog and spray. They save adjacent transformers, switch gear, and nearby structures.

Blaw-Knox protection now means for the future reduced danger, minimum losses, and a quicker return to service if fire should strike.



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46th Annual Statistical and Forecast Number

is coming January 30th

THE INDUSTRY YEAR in output, capacity, new capacity, energy sales, revenue, customers, financial and budget, labor, rural lines, etc.

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TECHNICAL LITERATURE

Power Converters—*Pool Cathode Mercury-Arc Power Converters* contains definitions, standards on service conditions, classifications for ratings, basis for performance characteristics, requirements for acceptance tests, test code, recommended practice and operating guide, and standards for rectifier transformers. This publication, designated ASA C34.1-1949, is published by American Institute of Electrical Engineers, 33 W. 39th St, New York 18, N. Y.

Capacitor Information—With a wallet-size card, engineers can compute the answers to three questions: How many kilovars?; What power factor?; How much voltage rise? Simplified diagrams illustrate the formula that will in each case allow quick computation. The card, titled "Pocket Engineer," and designated GEN 22, is available from General Electric Co, Apparatus Dept, Schenectady 5, N. Y.

Steel—*ASTM Specifications for Rolled Structural Steel* covers general requirements for delivery of plates, shapes and bars under headings such as steel for bridges and buildings, structural silicon steel, low-alloy structural steel, structural rivet steel, low and intermediate tensile strength carbon-steel plates of structural quality. Copy of the pamphlet, at $1 each, can be obtained from American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.

Impulse Voltage—*Impulse Sparkover and Discharge Voltage Characteristics of Lightning Arresters and Their Co-ordination with Impulse to Withstand Voltage Characteristics of Transformer Insulation* presents fundamentals of this subject and is illustrated and written in semi-technical language. This 12-page publication has been issued by Electric Service Manufacturing Co, 17th and Cambria St, Philadelphia 32, Pa.

Lighting—*Sports and Recreational Lighting* discusses lighting for outdoor applications, indoor applications and the operation and care of lighting equipment. Tables, sketches and illustrations contribute to the practical value of the handbook. This 37-page publication is available at a price of 45¢ from General Electric Co, Lamp Dept, Nela Park, Cleveland, Ohio.

Canadian Standards—Following have been issued as part of the Canadian Electrical Code: *Tolerable Limits of Radio Interference from Radio Frequency Generators—Industrial, Scientific and Medical*; C22.4, 106-1949, price 50¢. *Use of Electricity in Metalliferous and Industrial Mineral Mines and Quarries*; C22.5, 1-1949, price $1. They are obtainable from Canadian Standards Association, National Research Building, Ottawa, Canada.

Turbines and Boilers—*Turbine and Boiler Overhaul Practice* is a report of the Turbines and Condensers Subcommittee of the Prime Movers Committee, Edison Electric Institute. Thirty member companies of EEI provided data describing the overhaul practice for 225 turbines having a total capacity of about 9 million kw, and 497 boilers having a steaming capability of about 112 million lb per hr. Information covers general overhaul practice and methods for inspecting specific items. Report is Publication R-13, available to members for 50¢ from Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.

Steel—Internal and external types of steel deterioration are discussed briefly in Tempil Topics, Vol 4, No. 7, *Deterioration or Breakdown of Steels in Service*, issued by Tempil Corp, 132 W. 22nd St, New York 11, N. Y.

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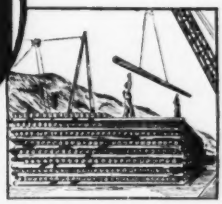

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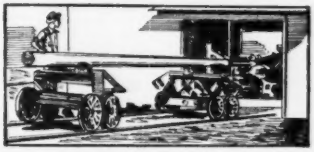

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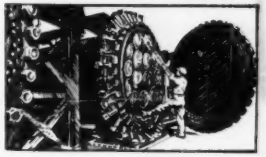

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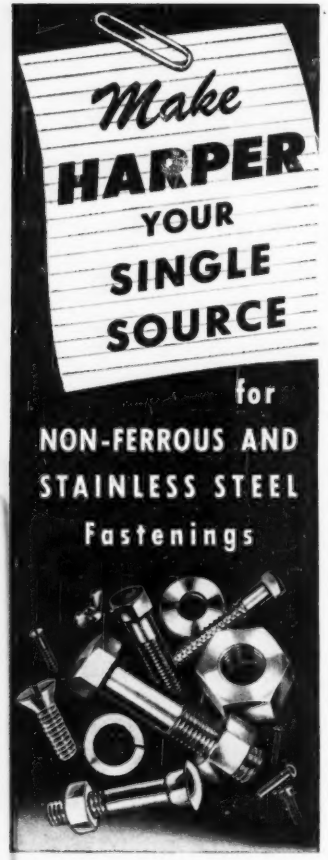

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● D-C MOTORS: Construction, application, and control of large d-c motors are covered in 39-page Bulletin 05B6002A. Allis-Chalmers Mfg Co, S. 70th St, Milwaukee, Wis.

● SUBSTATIONS: Information about rural package substations and equipment for four basic arrangements is presented in a 20-page booklet, GEA-5276. General Electric Co, Apparatus Dept, Schenectady 5, N. Y.

● GROUNDING: Publication 4906 provides information on automatic high-speed grounding switches. Delta-Star Electric Co, 2400 Block Fulton St, Chicago 12, Ill.

● LUMINAIRE: A 12-page catalog describes the totally enclosed, Hartford luminous downlight luminaire. The Miller Co, Meriden, Conn.

● INSULATION: Sectional layer-by-layer diagrams and construction features of Rockbestos AVC cable appear in a pocket-sized, illustrated booklet, "The Story of an Insulation." Rockbestos Products Corp, New Haven, Conn.

● CAPACITORS: Power factor correction, voltage improvement, and installation information about shunt capacitors is given in Bulletin 21-1. James R. Kearney Corp, 4236 Clayton Ave, St. Louis 10, Mo.

● SWITCHBOARDS: Photographs and non-quantitative information about power control equipment is covered in Switchboard Catalog PL-100. Taller & Cooper Inc, 75 Front St, Brooklyn 1, N. Y.

● MOTORS: Construction features and applications of fractional hp motors are shown in Catalog 102. Franklin Electric Co Inc, Bluffton, Ind.

● CABLE SPLICING KITS: Bulletin CJ5 describes kits, in unit packages for convenience, for making two-way joints of rubber insulated, lead covered 1/c, 2/c, 3/c and 4/c cables. G & W Electric Specialty Co, 7780 Dante Ave, Chicago 19, Ill.

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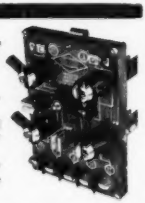

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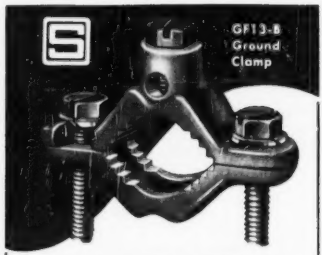

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BOOK REVIEWS

Electrical Engineers' Handbook: Electric Power. By Pender and Del Mar. Published by Jonn Wiley & Sons, Inc, New York 16. 1,720 pages, illustrated. Price $8.50.

This fourth edition has a companion volume devoted to electric communication and electronics and both are part of a series for electrical, mechanical and mining engineers. More contributors participated in its preparation and this is evidenced by expansion of several subjects including system stability, symmetrical-component fault analysis, rectifiers, aircraft electrical systems, magnets, plastics and electric heating. The largest sections are those devoted to transportation and to transmission and distribution systems; the latter (including the separate section on rural lines) constitutes nearly one-fifth of the book. About equal space is devoted to measurements and alternating current machinery. The index comprises some 6,500 entries which seem to embrace most of the salient items of information. Unfortunately there is no thumb index and some of the bibliographies contain a large fraction of references dated prior to the interval between editions.

Scope of the handbook ranges from materials, circuits, electrochemistry meters, circuit components, batteries, generators, motors, transformers, rectifiers and switchgear to plants, transmission, distribution, lighting, heating and transportation. The treatment of industrial requirements is quite brief.

Modern Oscilloscopes and Their Uses. By J. H. Ruiter, Jr. Published by Murray Hill Books, Inc, New York 16. 326 pages, illustrated. Price $6.

A 50/50 balance typifies the author's efforts to discuss the principles, structural details, auxiliaries and pattern-interpretation as decisively as the uses to which oscilloscopes can be put. The elucidations should be most helpful to those who have opportunity or occasion to use the various forms of oscilloscopes in analyzing electronic apparatus (radio, carrier, television, transmitters), in teaching and in such industrial applications as studying the performance of welding apparatus, camera shutters and ignition systems. A closing chapter gives help in photographing cathode-ray patterns and an appendix has a glossary of some 200 terms of the art of oscilloscopy.

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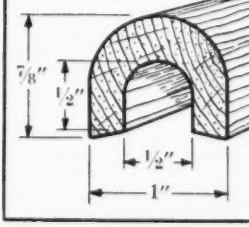

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LETTERS TO THE EDITOR

Control of Sulfur Dioxide

To the Editor of ELECTRICAL WORLD

Dr Wolfe and I appreciate your favorable reference, in ELECTRICAL WORLD of October 22, to our paper at the Birmingham meeting of the Smoke Prevention Association of America. However, we regret very much the interpretation given the portion of the paper on sulfur dioxide. On this subject we said:

"The subject of stack discharge gases in the atmosphere has come up at infrequent intervals and in widely scattered areas, generally as a result of unusual local conditions. There is now no commercial solution to this problem except to install high stacks to provide for the safe diffusion of the gases even under adverse atmospheric conditions. Individual power companies . . . are working towards acceptable methods of sulphur removal. This work has not progressed to the point where definite conclusions may be drawn. . . . It is hoped that eventually a commercially satisfactory method may be developed to take a large part of the sulfur out of the coal and at the same time reduce the ash content. . . ."

You will note that this refers to the investigations of removal of sulfur dioxide from the stack gases but it certainly was not our intent to suggest that this is a satisfactory solution to the problem. . . . After extensive research and investigation. It is the opinion of Dr Wolf and myself that slack gas washing should not be held forth as a procedure to be followed in this country.

. . . Widespread and oftimes misleading publicity given the Donora incident and the Los Angeles smog problem has led many to believe that similar conditions are quite general. If this erroneous impression is not corrected, we shall quite likely be faced with unwise and costly legislation . . . Our industry . . . should take every reasonable opportunity to inform the public correctly. At present there appear to be only three practical means of controlling sulfur dioxide in the atmosphere near power plants: (1) Careful selection of plant location, (2) control of individual plant output within reasonable limits and (3) use of high stacks and high exit gas velocity. . . .

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A. C.—50 AND 60 CYCLES

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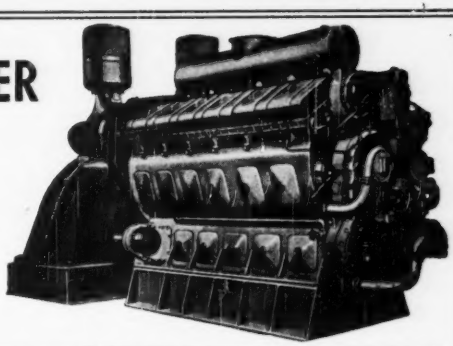

A PARTIAL LIST OF OUR INVENTORY

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1875	Fairbanks Morse	33F16	2000	300	375	Enterprise	DSG-6	450	450
1420	Fairbanks Morse	38D8⅛	1600	720	330	Superior	KNA	396	514
1250	General Motors	16-278A	1600	720	312	General Motors	8-268A	450	1200
937.5	General Motors	12-567	1080	720	187	Ingersoll Rand	S	225	514
625	Alco	6-12½x13T	750	600	125	General Motors	3-268A	150	1200
425	Baldwin	VO-6	510	450	75	General Motors	6043C	90	1200

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KW	Make	Desc.
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750	G.E.	Condensing—250 lbs. I.S.P. 440 v. 3 ph. 60 cy.—Built 1944
300	G.E.	Non-condensing 150/175 I.S.P. 5/10 B.P.—480 v. 3 ph. 60 cy.
400	Whse.	Non-condensing 125/150 lbs. I.S.P. & 10 lbs. B.P.—240/480 v. 3 ph. 60 cy.

SYNCHRONOUS CONDENSERS

KVA	Make	Type	Volts	Speed
5140	Whse.		2400/4150	600
4000	G E.	TSC	2400/4150	900
3000	Whse.		2400/4800	720

MOTOR GENERATOR SETS

3 ph. 60 cy.

KW	Make	Speed	DC Volts	AC Volts
1800	G.E.	600	125/250	2300/4150
1500	G.E.	360	275	2200/4400
1500	G.E.	600	600	2300/4150
1250	G.E.	600	275	4150
1000	Whse.	900	600	4150

TRANSFORMERS—60 Cycle

Kva	Make	Type	Ph	Voltages
2666	Whse.	OISC	1	66000x11000
2500	Al. Ch.	OISC	3	13200x2300
2500	Pack.	AT	3	13800x2300
1250	G.E.	HVDDJ	1	6600x550
1000	Pitts	OISC	1	13200x2300
600	Al. Ch.	OISC	3	2300/4150x220/440
333	Pitts.	OISC	1	26400x2600
167	G.E.	HS	1	2400x240-480

FREQUENCY CHANGERS

2000	KW	G.E.	25/60 cy. 2300/2300 v
500	KW	A. C.	25/60cy. 11000/2300v

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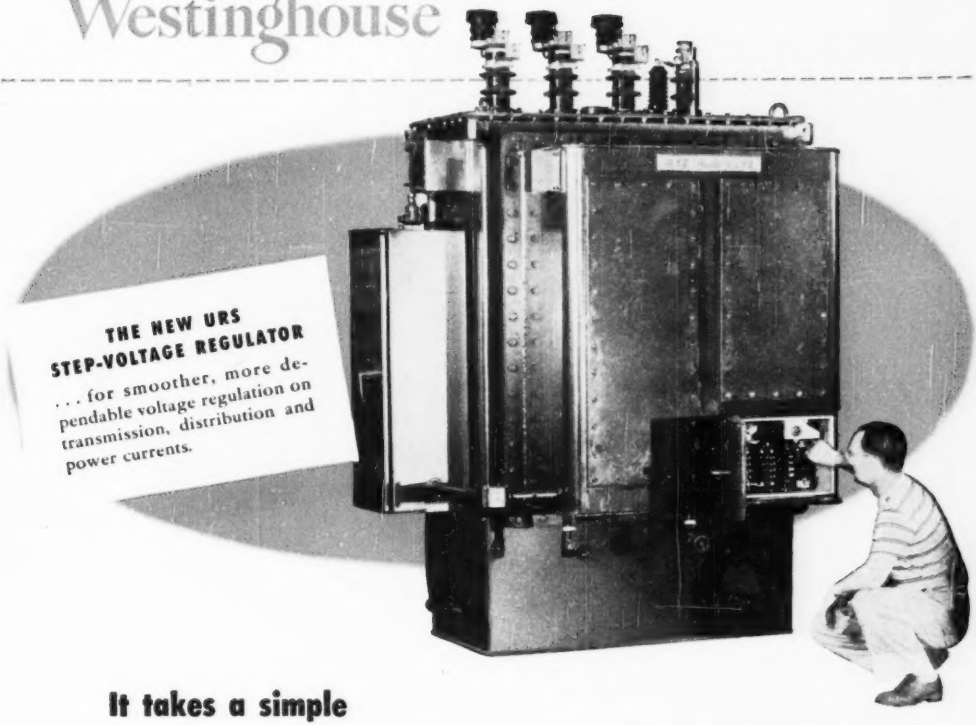

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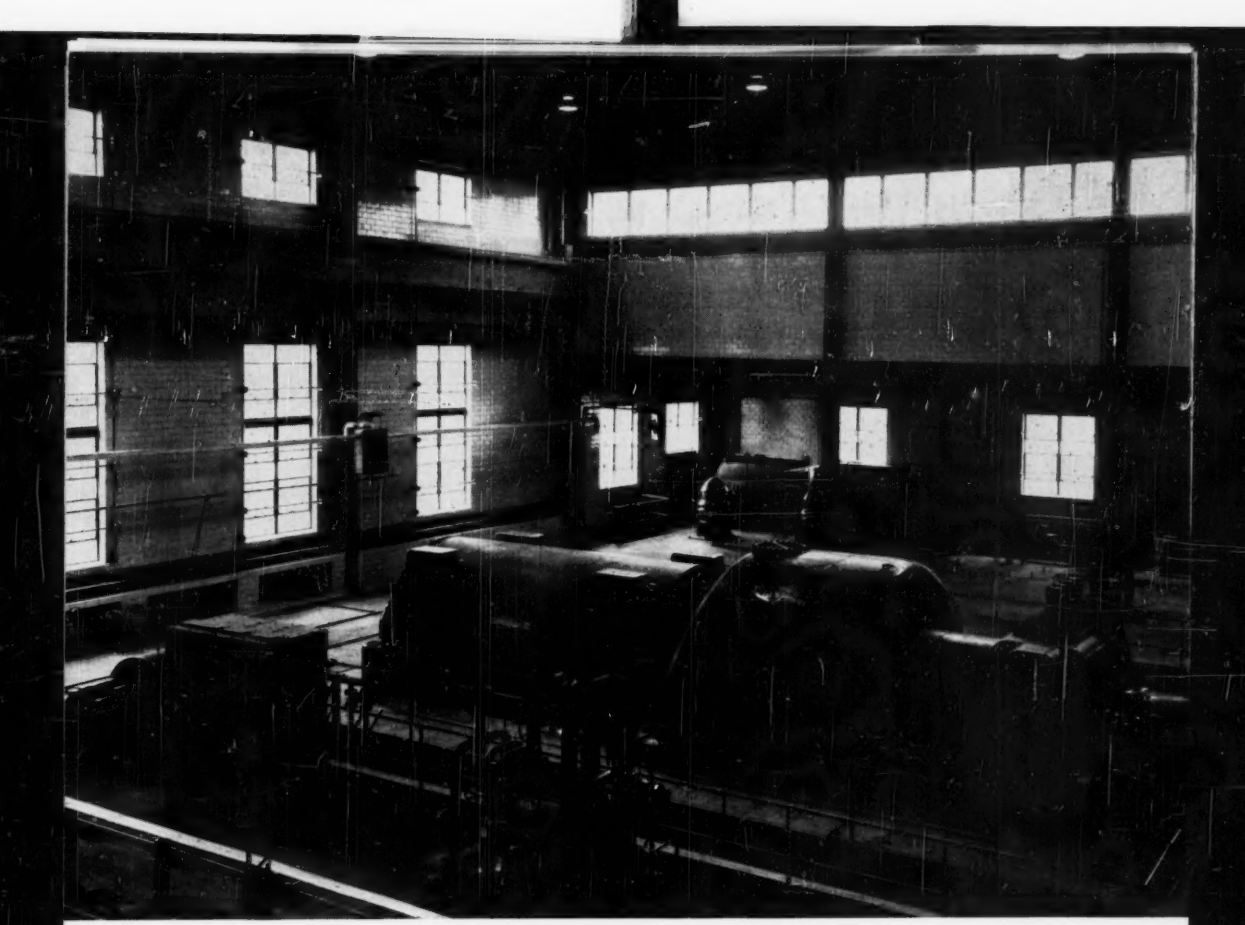

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